

# Subterranea

December 2014 Issue 37

ISSN 1741-8917

## **In This Issue...**

**Barnton Quarry Bunker Restoration**

**East German Communications Bunkers**

**Sub Brit Aldwych Station Visit**

**Foot Tunnels Beneath The Thames**

Subterranea Britannica



[www.subbrit.org.uk](http://www.subbrit.org.uk)



Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.

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**Front cover photo:** The plant room in the ROTOR R4 at Barnton Quarry in 1998. On the left is the main Baudelot heat exchanger. This exchanges heat with chilled water coming from the forced-water/air heat exchangers beyond the rear emergency exit blast doors. To the rear of the main Baudelot tank on a concrete plinth is the shell of one of the main refrigerant compressors. Just in front of the plinth would have been set the tube condensers where the refrigerant was cooled out of the vapour state but these have been removed. To the rear there is a mass of ventilation trunking and an upturned ventilation fan. The plant on the right is the main air-conditioning plant unit. Compare this view with the view of the plant room on page 22. A number of features are seen in both pictures. Photo Nick Catford

**Back page upper:** The Sector Operations room at the Dundee ROC Group Control at Craigiebarns as seen from beside the sector controller's desk. You can see Display E on the map board on the right and beyond it, the continental tote. Display T is complete in the light-up frame, but Display A, B1 and B2 still need to be traced from drawings. Photo Mark Dalton

**Back page lower:** The site of the crossover at the south end of Platform 5 at Holborn station seen during a visit for Sub Brit members in 2008; Aldwych station is straight ahead. The track in the tunnel to the left was lifted c.1917. Although the Aldwych branch was closed from 3 October 1994 the track is maintained in good order and can be used if required by film companies. The 4-car shuttle used on the branch is usually stabled at Aldwych station (see picture page 53). Photo Nick Catford

### Officers

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Vice Chairman: Linda Dixon  
Secretary: Roger Starling  
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Treasurer: Tony Radstone

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Andrew Smith : PR  
Chris Rayner: SB Meetings

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Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the Editor etc are welcome.

However the Editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

Printed by Hierographics Ltd, Sandford Lane, Wareham, Dorset BH20 4DY 01929 554454

Subterranea Britannica A Company limited by Guarantee Registered in England and Wales Registration No. 6447148  
Registered Charity Number 1141524 Registered Office: Heathend Cottage, Windsor Road, Ascot, Berkshire SL5 7LQ



# Chairman's Welcome

Martin Dixon

Although I'm writing this before the end of the year has finally arrived, the December edition of *Subterranea* seems a good opportunity to look back on 2014. And what a year we've had! To mark our 40th anniversary Sub Brit held a splendid subterranean banquet in the Thames Tunnel entrance shaft and followed this up with a special *Subterranea* supplement recording some key events in our history.

In terms of trips for members, these have been far and wide (and deep!). Individual sites visited have included most of our interests – everything from air-raid shelters, mines, disused tube stations and Cold War bunkers through to art installations, urban farms, prisons and catacombs. Many members have taken the time to show off their own sites or joined in the guiding at Paddock. Plus there's been the opportunity to join some fantastic weekend events – to the Czech Republic, Scotland, Wales, Newcastle and Poland. For those unable to make the trips we always try to ensure they are written up in *Subterranea* and advances in printing technology mean we can now afford to print our magazine in colour throughout. Not that Sub Brit sticks to printed media; our social network presence now reaches around 5,000 people and our recently-launched Members' Forum brings new vibrancy and images to discussions between members.

Membership levels are over 1,100 and the income generated from shop sales and gift aid claims has allowed us to help fund projects such as the Fan Bay excavation and small museums such as the Brunel Museum. 2014 also marked the year when Dan Cruickshank became our

President and we hope to have a long association together. The implementation of the Forum has shown that Sub Brit members have different perspectives on many things. Just to take site visits, some members prefer locations that are near original; others enjoy gentle dereliction. Some appreciate a tour by a knowledgeable expert; others would rather discover a site for themselves. Many members take meticulous photographs whereas others are content to soak up the atmosphere through their own senses.

With 1,100 members, it is unlikely that we will agree on many things – whether it is our favourite colour or the best way to skin a cat! Debate and discussion are healthy but let's all try and ensure that we spend our greatest energies in celebrating our shared passion for the underground, rather than accentuating our differences.

2015 promises to have all the makings of another great year. Spring alone will bring opportunities to spend weekends underground in Rome and Hamburg and closer to home our Spring Conference will include lunch in the price to increase the opportunities for members to spend time together.

To the Committee who work so hard behind the scenes, thank you. To other members who have got involved in 2014, sincere thanks for helping make *Subterranea Britannica* the great organisation that it is. And to those of you reading their first *Subterranea*, a very warm welcome. And to everyone, I hope your New Year Resolutions for 2015 both above and below ground are all achieved!

chairman@subbrit.org.uk

## Meet the committee - Richard West

I've enjoyed being a committee member for about three years now, having decided that I wanted to be more involved in the way Sub Brit was run. Better that, I thought, than just moan about the way other people ran it! We meet three times a year and the committee meeting lasts all day - but we achieve a great deal in that time. In between meetings a lot of work is done behind the scenes - on e-mail and now via the Forum. I've recently picked up the additional job posting out welcome packs and magazines, where appropriate, to new members. At certain times of the year this can mean almost daily visits to the Post Office. When I'm not on (excellent) Sub Brit trips I get together with like-minded fellow Sub Britters on our own trips or the occasional get-together for a beer.

In my "spare time" I'm a volunteer at the London Transport Museum where I have a number of roles. I started there restoring signalling equipment at the Acton depot – a wonderful place full of all sorts of (London) transport related "stuff" including trains, buses, posters, signs, a "small items" collection and much more. Now I do family tours of the Depot (you get far too many difficult questions



from an adult tour) and help run schools activities there. I also help run schools and family activities for the Learning department at Covent Garden. My subterranean interest is fulfilled by being a tour guide for Aldwych disused underground station. (see p. 51) I'll be organizing another Sub Brit trip early next year where, as last time, I'll be extending the normal public tour. The London Transport Museum, on behalf of TFL, are hoping to open up more underground space to the public – more to follow.



# SUBTERRANEA BRITANNICA DIARY

## Summary of Forthcoming Events

### Sub Brit specific events

#### 2015

- 17 January SB Committee meeting  
1 March Copy deadline for *Subterranea* 38  
18 April SB AGM & Spring Meeting, Imperial College, London  
Late April *Subterranea* 38 published  
15 - 18 May Study Weekend, Hamburg - **See panel for information page 63**  
May (TBC) Paddock open day  
20 June SB Committee meeting  
1 July Copy deadline for *Subterranea* 39  
Late August *Subterranea* 39 published  
4 - 6 September UK Study Weekend, Gloucestershire  
19 September Paddock open day  
September / October (TBC) SB Autumn meeting  
17 October SB Committee meeting  
1 November Copy deadline for *Subterranea* 40  
Mid-December *Subterranea* 40 published

#### Other underground-related events

- 11-17 March Hypogea 2015, Rome - Underground conference & visits  
25 April SERIAC conference, Southampton  
9 May, 13 June, 11 July, 8 August, 12 September Reigate Caves public open days  
22-24 May NAMHO Conference – Nenthead, Cumbria  
10-13 September Heritage Open Days, England  
September (TBC) Open Doors, Wales <http://cadw.wales.gov.uk/events>  
September (TBC) Doors Open Days, Scotland  
September (TBC) European Heritage Open Days, Northern Ireland  
19-20 September Open House London  
25-27 September Hidden Earth – Bristol  
TBC SFES Congress, France

For web links to these events please visit [www.subbrit.org.uk/events](http://www.subbrit.org.uk/events)  
or contact the Society concerned

*If you know of other relevant events run by other societies, please let us know  
so that they can be advertised in the next edition and on the website*

### Sub Brit on eBay

Readers may be interested to know that we have recently registered Subterranea Britannica on eBay as an 'eBay for Charity' partner. This means that anyone can nominate Sub Brit to receive a percentage (between 10 and 100%) of the proceeds of any eBay sale. More general information is on the eBay website



Our own home page from which you can initiate a sale is at:

[http://donations.ebay.co.uk/charity/charity.jsp?NP\\_ID=64157](http://donations.ebay.co.uk/charity/charity.jsp?NP_ID=64157)

There's no pressure to do so but any money received will, of course, be used for our charitable ends



# ANNUAL GENERAL MEETING 2014 - MINUTES

26th April 2014 at 10.05am

Lecture Theatre 1.31, Royal School of Mines,  
Imperial College, Prince Consort Road, London SW7 2BP

The meeting was opened by the Chairman, Martin Dixon, who welcomed all those attending – especially new members. 104 members were present.

1. Apologies were received from Hugh Ainsley, John Gurney, Mark Russell, Richard Savage, Bob Clary, Gerald & Danuta Tagg, Tony Radstone and John Burgess.
2. The motion to adopt the Minutes of AGM of 20th April 2013 was proposed by Andrew Smith, seconded by Richard West, and passed “*nem con*”.
3. The Chairman highlighted some of the key achievements of the past twelve months, as recorded in the Annual Report (which had been made available in advance of the meeting):
  - Three issues of *Subterranea* published
  - Active email news list
  - Spring and Autumn Meetings
  - Long weekends in Gothenburg and Devon
  - ‘MySubBrit’ added to Website
  - Around 4,000 social media subscribers
  - Sub Brit registered as an eBay charity
  - Gift Aid used to fund projects
  - Public openings
  - Official and Member-organised visits
  - Fieldwork around the UK
  - Sales of publications direct & via Amazon

The Chairman gave thanks to all those who had contributed to these and other activities and gave particular thanks to the Committee for their hard work and support. Looking forward, he said that 2014 would mark the 40th anniversary of *Subterranea Britannica*’s foundation, and a celebration dinner had been arranged to take place in June. The Autumn meeting would take place in Newcastle upon Tyne, together with a number of associated visits, and there would be a long weekend in the Czech Republic. There would be continued funding of suitable projects, and it was hoped to further develop the website.

4. The Chairman reported that the Sub Brit accounts had been independently examined and lodged at Companies House and with the Charity Commissioners. They had also been circulated/made available to members in advance of the AGM. In answer to a question from the floor, the Chairman confirmed that none of *Subterranea Britannica*’s funds were restricted in their application.
5. A motion that nominations for election be considered “en bloc” was proposed by Stewart Wild, seconded by Nigel Wall, and passed “*nem con*”.
6. A motion to elect the following Officers and Committee for 2013/2014 was proposed by Andrew Smith, seconded by John Shere and passed “*nem con*”.
  - Martin Dixon (Chairman)
  - Linda Dixon (Vice Chairman)
  - Roger Starling (Secretary)
  - Nick Catford (Membership Secretary)
  - Tony Radstone (Treasurer)
  - Chris Rayner
  - Mark Russell
  - Richard Seabrook
  - Andrew Smith
  - Paul Sowen
  - Bob Templeman
  - Richard West

The meeting closed at 10.25am.



## NEWS

Miscellany compiled by Paul Sowan  
and Nick Catford

### Archaeology

#### Mexico archaeologists explore Teotihuacan tunnel

A yearlong exploration of a tunnel sealed almost 2,000 years ago at the ancient city of Teotihuacan yielded thousands of relics and the discovery of three chambers that could hold more important finds, Mexican archaeologists said recently.

Project leader Sergio Gomez said researchers reached the end of the 340-foot tunnel after meticulously working their way down its length, collecting relics from seeds to pottery to animal bones. A large offering found near the entrance to the chambers, some 59 feet below the Temple of the Plumed Serpent, suggests they could be the tombs of the city's elite.

Because this is one of the most sacred places in all Teotihuacan, archaeologists believe that it could have been used for the rulers to acquire divine endowment allowing them to rule on the surface. Unlike at other pre-Columbian ruins in Mexico, archaeologists have never found any remains believed to belong to Teotihuacan's rulers. Such a discovery could help shine light on the leadership structure of the city, including whether rule was hereditary.



A robot camera is prepared to enter the tunnel located below the Temple of the Feathered Serpent

So far the team has excavated only about 2 feet into the chambers. A full exploration will take at least another year. Initial studies by the National Institute of Anthropology and History show the tunnel functioned until around A.D. 250, when it was closed off. Teotihuacan long dominated central Mexico and had its apex between 100 B.C. and A.D. 750. It is believed to have been home to more than 100,000 people, but was abandoned before the rise of the Aztecs in the 14th century. Today it is an important archaeological site on the outskirts of Mexico City and a major tourist draw known for its broad avenues and massive pyramids.

SOURCE: *Phys.Org* 29 October 2014

#### Final report on the 1972 – 76 Grimes Graves excavations, Norfolk

DETAILS: LONGWORTH, Ian, Gillian VARNDELL, and Jack LECH, 2012, *Excavations at Grimes Graves, Norfolk, 1972 – 1976. Fascicule 6*. London: British Museum Press: 208pp [ISBN 078-0-71412-231-8]

Archaeological excavations were conducted at the Grimes Graves flint mines site by a British Museum team in the years 1972 – 1976, with reports on various aspects of the work published from time to time, the final (sixth) such report having just come to notice, although published in 2012.



Photo by Tony Shertila

Apart from the physical shapes and sizes of the mine shafts and galleries, much else has been studied in great detail, and reported on. It is concluded that this extensive site (Scheduled as an Ancient Monument) is of late Neolithic date, and was far more than just an industrial site, as excavation of the land surface above and around the mine shafts has demonstrated. This is arguably more important and instructive than the underground exploration. An earlier estimate of 366 mine shafts has been revised to over 400. Another estimate, concerning the time taken to dig one of these mines, is about 93 days, suggestion the 400+ shafts may have been sunk during a period of from 50 to 200 years of mining activity (assuming, presumably, only one mine at a time was worked). So, 36 years after excavations ceased, the final part of the report is published: it costs £ 60.

#### Vlad the Impaler's underground prison is found

Restoration workers in the Tokat Castle in Turkey have discovered a secret tunnel leading to the Pervane Bath and a military shelter. Two dungeons have also been discovered in the castle, where Wallachian Prince Vlad III the Impaler, who was also known as Dracula, is said to have been held captive in the early 15th century.

Prince Vlad III and his brother Radu are believed to have been held at the castle in 1442 by the Ottomans. Vlad, who was born between 1428 and 1431 in Sighișoara Transylvania, is the prince who is the inspiration for Bram Stoker's 1897 gothic novel *Dracula*. The town of Tokate was conquered by the Seljuk Turks at the end of the 12th century and was incorporated into the Ottoman empire





in 1392. Tokat Castle, a ruined citadel also known as the fortress Dazimon, lies on the steep hills above the city. Vlad earned his name due to his historical reputation of impaling his victims, having developed an intense hatred of the Ottomans during his captivity. During his lifetime, news of his brutality and excessive cruelty spread abroad to Germany and elsewhere in Europe.

In 1462, Vlad is said to have retreated from a battle against the Ottomans and impaled and displayed the bodies of 20,000 people outside the city of Targoviste, in Romania, as a deterrent against the oncoming Ottoman forces. Upon seeing the bodies being picked apart by crows, the forces turned back to Constantinople. Vlad the Impaler was eventually arrested and held in prison for 12 years.



Torkat Castle

After his brother's death in 1475, he managed to reclaim the Wallachian throne and he is believed to have died in battle against the Ottomans in 1476.

SOURCE: *International Business Times* 29 September 2014

### **The 'lions' den' at Earls Court, London**

Land at the then rural Middlesex village of Earls Court was purchased by the renowned anatomist and surgeon John Hunter [1728 – 1793] in 1764, the original house being replaced by a new one built for him the following year. A substantial artificial mound containing 'subterranean' dens was constructed in the grounds, although whether inhabited by lions or not, though supposed, is not proven. Two images of this structure, one a photograph taken in 1886, have been published. Earls Court House was demolished in or about 1896 and the whole site built over.

SOURCE: HICKMAN, Clare, 2014, The garden as a laboratory: the role of domestic gardens as places of scientific exploration in the long 18<sup>th</sup> century. *Post-Medieval Archaeology* 48(1), 229 – 247.

## **Military and Defence**

### **King's Lynn air-raid shelter opens to the public**

More than 3,800 people climbed down the steps into a recently rediscovered King's Lynn air-raid shelter in September when it was the star attraction during the town's Heritage Open Day.

The shelter was built for use in the Second World War but



was covered over after the war and forgotten. Workmen found two shelters by accident below King's Lynn's Tuesday Market in May 2014 when carrying out surveys ahead of the resurfacing of the area. The shelters are 8 - 10 feet deep and would have accommodated 350 - 400 people. One of them has now been cleaned and modern lighting has been fitted, it's hoped it will open more often.

SOURCE: *KLFM News* 15 September 2014

### **Deptford Cold War control demolished**

The old Deptford Urban District Council control centre behind Deptford town hall has been demolished. Southwark council vacated the bunker, central stores depot and the Neckinger depot behind when they moved to new premises. The old town hall (basement was also a WWII ARP control) is now apartments and the depot demolished with luxury flats being built on the site.

The bunker used the existing basement of Neckinger depot but was given a blast-proof entrance at front onto courtyard behind the town hall. It opened in 1954.

Latterly the depot was used as an arts co-operative with workshops funded by the council. When visited in 2001 it was stacked floor to ceiling with old furniture with just room nameplates to indicate its former Cold War use. The generator had been removed. At the time of this visit the keys couldn't be found and the lock on the door had to be cut off.

SOURCE: Keith Ward

### **Chinese nuclear bunker becomes tourist attraction**

In the 1960s Chairman Mao Zedong ordered regional governments across China to build nuclear bunkers in case of a surprise attack from the Soviet Union.

Many of the bunkers such as the one in Ruichang built into the side of a mountain in Chinese Jianxi Province, abandoned for many years, are now being reborn as potential tourist attractions.

The interior of the bunker is protected by two large blast doors which lead to an access corridor. Workers tunnelled through solid rock to create the complex which was designed to survive a nuclear strike. The bunker in Ruichang consists of just six rooms and an area set aside in the centre of the bunker 100 metres below ground to act as an armoury. There was also a control room.





A large number of these shelters were built across China. The construction project continued from the 1960s and into the 1970s as Chinese leadership were fearful over the intentions of their northern Communist neighbour. Some of the bunkers, including Ruichang, were used in the summer to allow people to spend time underground where the air temperature is considerably cooler, allowing them to escape from the sweltering conditions.

SOURCE: *Mail Online* 23 October 2014

### **Victorian munitions railway tunnel found under Carrickfergus Castle. Northern Ireland**

Archaeological excavation at Carrickfergus Castle, on the north shore of Belfast Lough in County Antrim, has revealed a Victorian tunnel driven through rock underlying the Anglo-Norman building. With rails remaining in situ, the tunnel appears to have been made to convey anti-submarine mines between the castle and ships moored at a nearby pier. As found, the tunnel had been partially backfilled with building rubble and clay.



SOURCE: Ó'BAOILL, Ruairi, 2014, Tunnel vision at Carrickfergus Castle. *Current Archaeology* 25(8)(296), 8 – 9.

### **Fallout shelters in Geneva find new use as homeless shelters**

As the 300,000 nuclear fallout shelters in Switzerland become less likely to be used for their initial purpose, the authorities in Geneva have decided to use them for a different sort of crisis.

The prospect of nuclear Armageddon breaking out on Lake Geneva in 2014 is unlikely. But that hasn't stopped Switzerland preparing for it. Since 1978, when a law was passed stipulating that all new buildings must incorporate

a shelter, over 300,000 have sprung up across the country, providing the possibility of protection for every Swiss citizen (and one million more besides).

Today, in the absence of any such threat, most bunkers lie empty and many are falling into disrepair. In Geneva, however, city authorities have found a novel use for these concrete Cold War relics. This winter, as they have done for several winters, the doors of two bunkers will swing open to welcome in homeless people.



Homeless people leave the Richemont shelter in the early morning.  
Photo Didier Ruef

Some 200 beds are on offer every night, from November to April, for people desperate to escape the freezing temperatures. Although guests must be out by 8am and can stay no longer than 30 days, the shelters are nothing short of a lifesaver for many. Last year, the bunkers received 1,500 people of 65 different nationalities, each guest staying an average of 19 nights. More than half came directly from the street; more than half had no income whatsoever.

SOURCE: *Guardian* 22 October 2014

### **Underground munitions store abandoned before completion, Shropshire**

A recently published visit report in a caving club newsletter describes and give some historical details for a disused limestone mine at Linley at an unstated location (probably near Wenlock in Shropshire). The mine appears to have been driven into beds dipping at ten degrees. In May 1941 the RAF commenced converting the space for munitions storage, but abandoned it unfinished after £ 1m had been spent. The adjoining surface site was used for storing 'obsolete bombs and storage cases'.

SOURCE: VAUGHAN, Mark, 2014, Linley caverns (old munitions store) 24<sup>th</sup> June 2014. *News of the Weald* 92, 5 – 6 [*News of the Weald* is the newsletter of the Wealden Cave and Mine Society]

### **'Des Res' with a difference offered for sale in Georgia**

During the 1960s the US Government initiated a secret plan called 'Continuity of Government and Communications'. This created the need for a secure method of maintaining essential communications throughout the country. Secret communication bunkers were built around the United States to withstand a





20 kiloton nuclear blast and maintain continuity of essential communication during times of war.

The original cost of construction in 1969 was \$7 to \$10 million each. Originally designed by the US Army Corps of Engineers and private architects, these facilities were run by trained AT&T staff (originally Bell Systems) until they were decommissioned in the 1990s. The majority of these facilities were either not hardened or above ground and not suitable for use as a secure site.

The fully underground and hardened facilities were very limited and there are less than five still in existence today. Until recently, one of these bunkers in southeast Georgia, near the city of Tifton, was in use as a training centre for military personnel in survival and disaster recovery. After two and a half years of renovations between 2010 to 2013 and over \$2.5 million invested, the newly refurbished compound can comfortably accommodate 30 people for up to one year.

The bunker has now been offered for sale. It comprises four fully self-contained luxury apartments, three staff apartments, commercial kitchen, home theatre, game room, office space, classroom, medical room, workshop, storage, armoury and private aquifer. The bunker is on two levels, 45 feet below ground and is accessed by a secure stairwell with a goods hoist. It is surrounded by hunting grounds and located near a lake with fish and other water amenities should the need arise. The value is estimated at between \$5 and \$50 million.

SOURCE: Colliers International sale brochure

## **Mining & Quarrying**

### **Clipstone colliery buildings under threat, Nottinghamshire**

Clipstone Colliery, Nottinghamshire, currently retains its twin headframes and winding engines, Listed Buildings, but these are under threat of demolition. A Clipstone Colliery Regeneration Group is opposing this, and pressing for regeneration of the site.

SOURCE: CLIPSTONE COLLIERY REGENERATION GROUP, 2014, Support for Clipstone Colliery. *Industrial Archaeology News* 170, page 16.

### **Hodbarrow Mine, Cumbria**

The *'Quarterly Journal for British Industrial and Transport History'* better known as *'Archive'* has now passed its 81<sup>st</sup> issue. It is known for its exceptionally well reproduced historic photographs of sites of industrial importance (including mines) and transport infrastructure, often very helpfully published alongside relevant Ordnance Survey historic large-scale plans, and intelligently informative captions and text. The articles are usually of generous length, and space lost to advertising is restricted to the front and back covers, the adverts in any case being for stand-alone books covering the same fields of interest.

Hodbarrow ironstone mine is featured in issue 80. This was very close to the coast, and there were inevitable

problems resulting from creating subterranean voids so close to the sea. The illustrations comprise five superb oblique aerial views of the surface structures and rail lines, and a large-scale OS 1924 plan extract. Appended are further such photographs and a plan for the nearby Roanhead mines near Dalton-in-Furness. Most issues of *Archive* have similar mining scenes, although more often for the more numerous collieries. Underground mining photographs also appear from time to time.



SOURCE: GRUDGINGS, Steve, 2013, Air pictures – discovering and cataloguing a unique archive. *Archive* 80, 20 – 35 [*Archive* is published by Black Dwarf Longmoor Publications Ltd, 120 Framers Close, WITNEY, Oxfordshire OX28 1NR / [www.lightmoor.co.uk](http://www.lightmoor.co.uk) . The firm also publishes books in the same fields of interest]

### **Hemmingfield colliery buildings protected, South Yorkshire**

The Friends of Hemmingfield Colliery have acquired this former mine site in South Yorkshire, and plans its development, including the surviving headframes and winding engines, as a celebration of the local mining heritage.



SOURCE: FRIENDS OF HEMMINGFIELD COLLIERY, 2014, Hemmingfield Colliery. *Industrial Archaeology News*, 170, page 21.

### **Poldark show mine reopened, Cornwall**

Poldark, a show mine for tin near Helston in Cornwall, having gone into administration, has now been sold for £ 350,000 and has now been re-opened for the summer season by the new owner, Dave Edwards.

SOURCE: ANON, 2014, Poldark sold. *Descent* 239, page 18.



### **Silver mines at Cerro Rico in danger of collapse, Bolivia**

Silver mining under the Cerro Rico mountain near Potosi in Bolivia has been pursued for nearly five hundred years, resulting in an irregular three-dimensional labyrinth of uncharted runnels and shafts, part of which are back-filled or collapsed. Small scale unofficial mining continues here and there. As a result of continuing falls of rock underground, the mountain is shrinking by a few centimetres a year, and is thought to be at danger of complete collapse. It has been put on the World Heritage 'in danger' list and some small-scale backfilling with cement has been undertaken.



Photo Tristan Savatier

The mines, formerly in Peru but now in Bolivia, are thought to have been started in or about 1545, and to have yielded around two billion ounces of silver, enriching Spain. Unknown numbers of lives have been lost here over the centuries, and the current unregulated operators are thought to be at risk from a major collapse of the mountain. Just such a collapse of irregularly mined ore (mostly copper) happened at Falun in Sweden (another World Heritage Site) where there is now a huge crater, although an impressive range of mine buildings and a well-presented underground tour in surviving (and stable) mine passages rewards visitors.

SOURCE: ANON, 2014, Bolivian mine collapse. *Descent* 239, pages 18 and 37.

### **Underground quarry now used for wine storage at Gastard, Wiltshire**

A number of the numerous and extensive underground building-stone quarries on the Somerset / Wiltshire borders east of Bath have found alternative uses. Members of Subterranea Britannica have, over the years, visited former WWII munitions stores and underground factories, a World War II secure museum store, the Cold War alternative seat of UK government, an underground quarry visitor attraction, a mushroom farm, and a secure document store and, indeed, still working stone quarries at three locations. A secondary use we have not yet visited is to be found at Eastlays Quarry at Gastard, where for 20 years a company called Octavian has stored 'millions of bottles of the world's most valuable wines'. The firm

has recently applied for planning permission to erect a 40 ft. high surface warehouse to hold an additional 300,000 cases of wine. What the inhabitants feel will be an objectionably intrusive addition to the village scene has been refused planning permission by Corsham town council. It is thought possible that Octavian will appeal.



SOURCE: PRYNNE, Miranda, 2014, Village sours plan to expand wine store. *The Daily Telegraph*, 26 April 2014.

### **Massive sinkhole or crown hole at Hemel Hempstead, Hertfordshire**

Clive Edmonds, a specialist in researching and coping with subsidences on the Chalk outcrop in England, has reported that at least 11 such events have been logged in February 2014, as against a normal monthly average of about one or two. He distinguishes as 'sinkholes' subsidences resulting from natural causes (chalk being dissolved by rainwater made slightly acidic by dissolved carbon dioxide), and 'crown holes' resulting from collapses of old chalk mines. Some extensive chalk mines are associated with former brickfields, chalk being mined below the brickearth deposits and incorporated in the manufacture to control shrinkage during firing. An exceptionally large subsidence in early 2014 affected 50 properties at Hemel Hempstead and is thought to belong to the 'crownhole' category. The crater was filled with 200 cubic metres of foamed concrete.

SOURCE: EDMONDS, Clive, 2014, Sinkholes: avoiding that sinking feeling. *New Civil Engineer*, 27 March 2014, page 15.

### **Remediation and costs of chalk mine subsidences**

More people than ever before, in all probability, are now aware that the chalk hills of southeast England are riddled with abandoned mines. The reason is the very high rainfall in early 2014 resulting in widespread mining subsidence.

Following the appearance of a hole on the central reservation of the M2 in Kent there were 'almost daily' subsidence reports in February. The costs of remediation (usually by grouting) have to date been met largely by the Homes and Communities Agency, rather than by homeowners and insurers. However, funds from that source are limited, and the buyers, sellers, and insurers or property can be expected to take rather more interest in future in recorded mining areas. Curiously some counties, such as





Surrey, have far fewer recorded chalk mines than others, such as Kent.

SOURCE: SMITH, Claire, 2014, Geotechnical: grouting. Sinking market. *New Civil Engineer*, 26 June 2014, page 18.

**Fun and games underground at Llechwedd, Blaenau Ffestiniog, North Wales**

The proprietors of the Llechwedd slate caverns, a tourist attraction at Blaenau Ffestiniog, have extended the range of underground activities on offer to their visitors. Additionally to the subterranean train ride and the reconstructions of historic slate mining scenes they have now installed slides and trampolines, for those who like that sort of thing!

SOURCE: ANON, 2014, Bouncing in Blaenau. *Descent* 239, page 18.

**Miscellaneous**

**Ron Martin steps down as Secretary of SERIAC and of the Sussex Industrial Archaeology Society**

Ron Martin, arguably the best and most important field archaeologist and recorder for industrial sites in south-east England, retired as the first and thus far only secretary of the South East Industrial Archaeology Conferences last summer. And in October 2014 his resignation as General Secretary of the flourishing Sussex Industrial Archaeology Society was announced. He has served with distinction in both capacities for some 30 years or so. More important, though, than his administrative roles has been his superb field recording of industrial structures, including subterranean ones. Ron’s measured drawings, many of them published in the Sussex society’s journal, are widely recognised as being of a standard few have emulated.

Ron was for a time a member of Subterranea Britannica’s Committee, and insofar as underground archaeology is concerned, collaborated with SB members Paul Sowan and Nick Catford on recording the astonishing and enormous cement and / or lime kiln hidden inside a hill in the South Downs at Beddingham, between Lewes and Newhaven.



Photo Martin Snow

SERIAC conferences have been held annually since the first at Guildford in 1983. They are organised in rotation by industrial archaeology groups in Berkshire, Greater London, Hampshire, Kent, Surrey and Sussex. The 2014 conference organised at Croydon by the Greater London IA Society included Nick Catford’s presentation on Underground London. Paul Sowan represents Subterranea Britannica on the SERIAC Committee, and makes sure that underground IA is not overlooked.

**Sale of the Mole Man’s house and tunnels, Hackney, London**

The late William Lyttle caused some concern to his neighbours and the local authority in Hackney by burrowing underneath his 20-room house and, it seems tunnelled also beyond the boundaries of his property. He had not sought or been given planning permission, and was evicted from the property in 2006 as there were concerns about his tunnels causing subsidence.



Photo by Karen Russo

The house has now been purchased by artists Sue Webster and Tim Noble, who have plans to develop it and surviving and stabilised tunnels as an arts location. SOURCE: ANON, 2014, Mole Man home will be an amazing studio. *The Evening Standard*, 12 September 2014, page 19.

**Exploding manholes again, London**

Piccadilly and adjoining streets were closed on 3 July 2014 as a result of another exploding manhole, seemingly an increasingly common feature of city streets. Flames from the manhole set fire to a lorry, which burned quite spectacularly near Fortnum & Mason’s. The event was accompanied by a power cut affecting nearby properties.



Many passers-by assumed at first the explosion and conflagration was either a gas explosion or a terrorist attack.

SOURCE: MORGAN, Ben, *et al.*, 2014, Explosions rock West End after cables set fire to lorry. *The Evening Standard*, 3 July 2014, page 13.

### **Wemyss Caves Society, Wemyss, Fife, Scotland**

Wemyss is a seaside place on the Firth of Forth (not to be confused with Wemyss Bay on the Clyde downstream from Glasgow) with apparently man-made but certainly man-used ‘caves’ of some antiquity excavated into the sandstone cliffs. The ‘caves’ have suffered grievously from the attentions of mindless youths some of whom in September 1986 drove a car into one of them and set it on fire. Local people, anxious to put a stop to such vandalism, formed a ‘Save the Wemyss Ancient Caves Society’ in that year. Carvings on the cave walls include abstract and Christian symbols, animals, and even a Pictish period (5<sup>th</sup> – 10<sup>th</sup> centuries AD) longboat. Lockable gates were installed, and organised public guided visits arranged. More recently the caves have been surveyed and photographed, and an online resource Wemyss 4D produced to allow for a wider than just local appreciation of the site. Visit [www.wemysscaves.co.uk](http://www.wemysscaves.co.uk) and [www.4dwemysscaves.org](http://www.4dwemysscaves.org).



Photo Julie Gotts

SOURCE: WEMYSS CAVES SOCIETY, 2014, Wemyss Caves Society. *Current Archaeology* 25(8)(296), page 58.

## **Books and Publications**

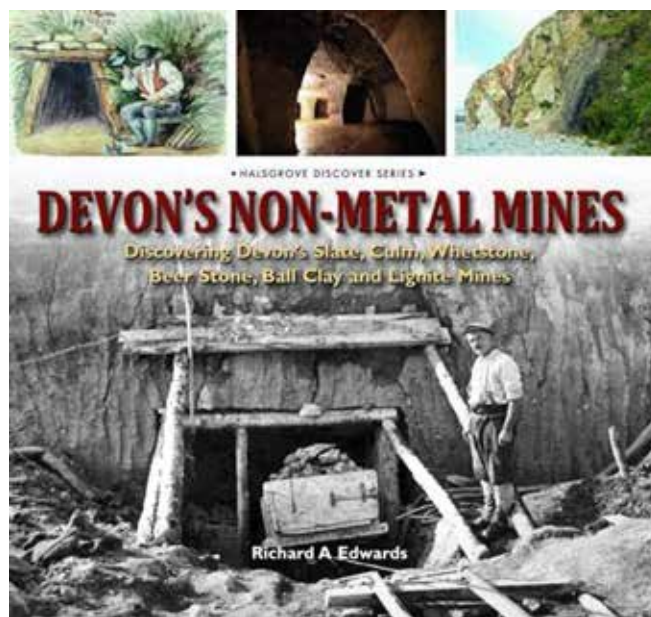
### **Devon’s non-metal mines**

DETAILS: EDWARDS, Richard A., 2011, *Devon’s non-metal mines: discovery of Devon’s slate, culm, whetstone, Beer stone, ball clay and lignite mines*. Wellington: Halsgrove: 166pp [ISBN 978-0-85704-118-0] £ 16.99.

This is a splendidly produced and reliably informative hardback volume. Richard Edwards is a professional geologist who has worked for the British Geological Survey and is the author of several of that body’s publications on the geology of Devon and elsewhere. Subterranea Britannica members have visited the Penn Recca slate mine near Buckfastleigh and the Beer quarry

‘caves’ worked originally for hard chalk for use as a building stone, but now operated as a tourist attraction. We have yet to visit the other locations.

Of the mineral products, it is explained that the little-known word ‘culm’ is used on and round Bideford for a variety of coal used both for fuel and as a mineral pigment called ‘Bideford black’.



Each of the six mining districts is described, with location maps, geological maps and geological sections, along with historical and modern photographs featuring both underground and surface views. It is stated that between them the mines described have been worked at various time from the Roman occupation onwards, the last actively worked mine (for ball clay) closing in 1999. The claim for Roman mining at Beer is open to question. The stone has been found in built fabric of that era at Seaton and in Exeter. But it is not known if this came from the underground quarry open to visit south of the road into the village, or from the now sealed tunnels north of the road, or from adjoining opencast sites. The proprietor of the ‘caves’ claims part of his tunnels to be Roman. The stone was certainly used extensively in the cathedral at Exeter, and was still mined in the 19<sup>th</sup> century.

Mine plans and large-scale Ordnance Survey plan extracts are given, as are ascertained historical facts concerning the miners and, where applicable, the mining companies, tools, associated railways and so forth.

The geological details in the text are explained clearly, and illustrated by helpful diagrams. It is not overloaded with the confusing array of technical terms used between themselves by geologists.

### **Ball clay mines at Purbeck, Dorset**

The so-called Isle of Purbeck, not in fact surrounded by water, is a tract of land in Dorset between Wareham and Swanage, a popular tourist area. Alongside a most attractive and unspoiled coastline, it has been home to a number of mineral industries, including underground





and opencast extraction of building-stones and Purbeck 'marble' from the Jurassic strata, and ball clay from the much younger Tertiary era.

Although this is primarily a book for those interested in industrial railways, it can also be recommended to those interested in clay mining, as the material was won both underground and in open pits.

DETAILS: LEGG, Chris, 2014, *Fayle's tramways: clay mining in Purbeck. Two hundred years, six different gauges*. Truro: Twelveheads Press: 167pp [ISBN 978-0-906294-79-6] £ 28.

### **Guide to the industrial archaeology of Cheshire**

DETAILS: Nevell, Michael, and David GEORGE, 2014, *A guide to the industrial archaeology of Cheshire*. Association for Industrial Archaeology: 77pp [ISBN 978-0-9560251-3-5]

The Association for Industrial Archaeology issues a guide book to sites and structures of interest in and around the location of its Annual Conference and programme of field visits each year. The 2014 Conference was based in Chester, and the sites visited were mainly in Cheshire, northeast Wales, and Liverpool. This year's guide deals with the two modern counties of Cheshire East, and Cheshire West & Chester, taking in such major towns as Congleton, Crewe, Ellesmere Port, Macclesfield, Nantwich, Warrington and Widnes. Some of these have now morphed into unitary authorities.

Many of the sites included in the guide are standing buildings, with the chemical industry well represented. Sites of specifically underground interest are as follows: Alderley Edge mines, worked for copper and small amounts of cobalt and other metals, and Bickerton Hill copper mines. Winsford Rock Salt mine (the oldest UK mine still working, and the only active mine left in Cheshire).

Collieries (surface structures) at Adlington, Poynton Lady Pit, and Poynton Reform Pit.

Tunnels in the Trent & Mersey Canal at Preston Brook, Barton, Barnton. Disley railway tunnel, and Halton railway tunnel at Norton.

## **Tunnels and Tunnelling**

### **Work starts on the last Crossrail tunnel in East London**

The boring of the last Crossrail tunnel to be dug in east London began in September. Tunnel boring machine Ellie has started her 900-metre journey from Limmo Peninsula near Canning Town towards the Victoria Dock Portal in east London.

Over the next three months the 1,000 tonne machine, named after four-time Paralympic champion Ellie Simmonds OBE, will complete one of Crossrail's shortest but most complex tunnels, which is close to the Jubilee line, Docklands Light Railway, River Thames and River Lea. The drive will complete tunnelling on Crossrail's southeast spur, which stretches from Stepney Green to

Abbey Wood. Ellie's sister tunnelling machine, Jessica, completed the first of the two twin-tunnels from Limmo to Victoria Dock earlier this summer.

Ellie has already successfully completed a tunnel from Pudding Mill Lane near Stratford, to Stepney Green. The tunnel machine is 150 metres long and 7.1 metres in diameter and is staffed by teams of 20 people. The concrete and steel tunnel segments are made in Chatham and transported to Limmo by river barge.

Crossrail will complete its tunnels next year when tunnel machines Elizabeth and Victoria, currently in Whitechapel, reach Farringdon in central London. Crossrail said its tunnels are 83 per cent complete and the project remains on time and within budget. Joint Venture Dragados Sisk is constructing the eastern tunnels between Pudding Mill Lane and Stepney Green, Limmo Peninsula and Farringdon, and Victoria Dock Portal and Limmo.



Ellie breaks through into the Victoria Dock portal on October 2014. Crossrail services are due to run through central London in 2018, and the Department for Transport is currently investigating a proposal to extend some services along the West Coast Main Line, via a new connection at Old Oak Common, to serve Watford, Hemel Hempstead and Tring. Such services could take Hertfordshire commuters to the heart of central London and Docklands, relieving some of the pressure on Euston at a time when that station is being rebuilt for HS2.

SOURCE: *Railnews* 11 September 2014

### **Greenwich and Woolwich foot tunnels under the Thames, London**

The public at large can walk under the Thames without special arrangements being made in advance at least three locations. There is a narrow but distinctly uninviting pavement alongside the motor road through the Rotherhithe tunnel, advised only for those who actually like motor cars and heavy lorries and their noise and stink! But at Woolwich and Greenwich pedestrians have quieter tunnels and clean air to themselves.

The Greenwich foot tunnel opened to the public on 4 August 1902, replacing a steam ferry boat which was the successor to a ferry which had conveyed people between Greenwich and the Isle of Dogs since 1676. The 112<sup>th</sup>



anniversary of the tunnel was celebrated by the Friends of Greenwich and Woolwich Foot Tunnels on 4 August 2014. The programme for this event saw welcoming music, an address by SB member and member of the local council Dr. Mary Mills, a musical procession through the tunnel, and tea at Island Gardens on the north side of the river.

The Greenwich foot tunnel was designed for the London County Council by Sir Alexander Binnie, excavation commencing in 1899. It has a length of 1217 feet between shafts, with an internal diameter of 11 feet, and was driven by a shield having an outside diameter of 12 feet nine inches. The lining is concrete and cast-iron segments. The contractors were J. Cochrane & Sons, the work cost just under £ 180,000, and compensation was paid to the ferry operators for their loss of custom.



Woolwich foot tunnel. Photo John King

Access was for the first few years via steps only, but lifts were installed in 1904, replaced with new ones in 1992. The shafts are 44 feet (88 steps) at the north end, and 50 feet deep (100 steps) at Greenwich. The Institution of Civil Engineers has designated this structure Historic Engineering Work 2203. The similar Woolwich foot tunnel (HEW 2199) dates from 1912.

Both tunnels have been refurbished by the Royal Borough of Greenwich, and new lifts have been installed at each end. SOURCE: flyer issued by the Friends of Greenwich and Woolwich Foot Tunnels, leaflet issued by Greenwich Council, and Denis Smith, 2001, *Civil Engineering Heritage: London and the Thames Valley* (Institution of Civil Engineers). Contact details are [www.fogwoft.com](http://www.fogwoft.com), @fogwoft, and email [fogwoft3@gmail.com](mailto:fogwoft3@gmail.com). See article page 64.

### **Plans to build a road tunnel under Stonehenge are revived**

The revival of proposals to divert through a tunnel the busy road currently running alongside Stonehenge has worried archaeologists.

The Stonehenge Alliance has written to the Secretary of State for Transport Patrick McLoughlin to express its concern at the short tunnel options being considered for Stonehenge as part of a wider plan to upgrade the A303. The government is considering a number of options to improve the A303, one of which is to build a 2.5 to 2.9km tunnel under Stonehenge.

However the group contests that the tunnel should exceed 4.5km in order to protect the site claiming that a shorter tunnel could result in significant harm being done to the World Heritage Site.

SOURCE: *Salisbury Journal* 15 October 2015

### **820-foot-high tunnels discovered in Antarctica**

A team of British scientists has discovered massive tunnels under an ice shelf in Antarctica. Researchers from a number of UK universities and the British Antarctic Survey – a research centre based on the continent – detected the tunnels when they flew a plane over the Filchner-Ronne Ice Shelf in West Antarctica.

Radar from the plane, as well as satellite photos, revealed that ridges and cavities on the surface of the ice sheet corresponded to tunnels lying at its base. British scientists discovered the tunnel using radar from the specially-modified plane. It revealed that ridges and cavities on the surface of the ice corresponded to 820-foot-high tunnels hidden at the base of the sheet

Researchers concluded that the placement of the tunnels means that they were most likely formed from meltwater – water released from melting ice – flowing underneath the ice sheet, over land, and into the ocean.

The data revealed that water moved beneath the ice in concentrated channels, similar to rivers. Scientists previously thought that meltwater flowed underneath ice sheets in more evenly-spread, thin, continuous sheets.

Researchers used a specially-modified Twin Otter aircraft to make the discovery. The plane, designed to operate in remote environment, was fitted with remote sensors that provided scientists with data on the land, ice and sea that it flew over. Specially-designed radar equipment deciphered the tunnels under the ice – it can also be used to pick out layers within the ice itself. Longer-term monitoring from the air can be used to record the break-up of ice sheets or atmospheric changes. The British team will now use its newfound knowledge of the under-ice tunnels to predict how exactly that ice shelf will melt in response to climate change.

SOURCE: *Mail Online* 24 August 2014

### **Railway tunnels not shown on Ordnance Survey maps and plans, London**

It has not been Ordnance Survey policy to map subsurface voids or, indeed, any shafts not visible from above (covered by a building, for example). An exception, usually, is railway and canal tunnels, which are usually dead straight from portal to portal, and the alignment of which can in any case (for the longer tunnels) be seen from the ‘air’ shafts mapped as surface features. An exception to this exception is the deep London tube tunnels. the positions of which, it seems, are not shown on even the Ordnance Survey’s largest-scale plans at five feet to the mile.

This became an issue in the course of the inquiry into what might easily have been a serious underground





railway accident on 8 March 2013 near Moorgate, when investigation of water running through the tunnel ceiling led to the discovery that two contractor's pile-drills had penetrated the tunnel. A train colliding with them would have been serious.

The Rail Accident Investigation Board's report reveals that the contractor's surface site plan showed no tunnel, so the operatives were not aware they were drilling above a live subsurface railway. Nor is such a tunnel indicated on current and historic maps published by the Ordnance Survey, or any other published maps located.

The OS generally shows main-line tunnels, but not London Underground ones other than the shallow cut-and-cover one such as found on the Circle and District lines. The OS seems not to have been formally notified of the change of management in 1975 of the length of tunnel in question from London Underground to a main line company, First Capital Connect. The change of ownership followed the horrific underground rail crash at Moorgate on 1975.

SOURCE: DAVIES, John, 2014, The light in the middle of the tunnel: how a misunderstanding of what's shown on OS maps nearly caused a rail disaster. *Sheetlines* 100, page 10 with additional comment.

### **Tunnels planned and proposed to Battersea, London**

The long-derelict Battersea Power Station site, on the south bank of the Thames alongside the rail lines southwards from Victoria station, is it seems about to be redeveloped. Transport for London is already planning an extension of the Northern line from Kennington to two new London Underground stations, at Nine Elms and Battersea. The Battersea Power Station Development Corporation is now making a case for Crossrail 2 to be routed via Battersea. The current Crossrail 2 proposals have the new tunnelled line running from between Clapham Junction and London Victoria via King's Road, Chelsea (one end of which is already served by Sloane Square). The Development Corporation proposes it should instead run via Battersea, with an interchange at the intended new Northern line terminus.

SOURCE: BEARD, Matthew, 2014, Battersea Power Station developer makes bid for new Crossrail 2 station. *The Evening Standard*, 11 August 2014, page 18.

### **Deepest tunnel ever constructed in London**

The deepest tunnel ever driven under London has recently been holed through. Thames Water's 6.5 kilometre Lee tunnel lies at depths of 75 to 80 metres below ground level. Tunnel boring machines a massive 8.6 metres in diameter have taken almost two years to excavate the new sewer. 800,000 tonnes of chalk have been removed to form the new bore.

The great depth was dictated partly by the required gradient to enable gravitational flow, and partly on account of the numerous other tunnels at shallower depths along the route. At this depth, the tunnelling was almost if not entirely in the Chalk underlying made

ground, London Clay, the difficult Lambeth and Harwich formation beds, and Thanet Sand. Groundwater pressures up to eight times atmospheric were encountered. The highest tunnelling rate achieved was 54 metres per day.

The tunnel is to transfer sewage from the Abbey Mills pumping station eastwards to the Beckton sewage treatments works, and will take material to be delivered from the new deep level 32 kilometre Thames Tideway sewer when completed, reducing or eliminating discharge of untreated effluent direct to the Thames as happens at present at times of peak flow. The pumping shaft at Beckton has an internal diameter of 38.5 metres, and is 86.5 metres deep.



SOURCE: COLE, Margo, 2014,. Lee tunnel: capital's hidden wonder. *New Civil Engineer*, 13 February 2014, 14 – 16.

### **Refurbishment of city centre road tunnels, Birmingham**

The main arterial road (A38) through Birmingham, partly tunnelled, carries approximately 85,000 vehicles each day. The tunnels were closed for six weeks in the summer of 2013 for refurbishment and improvements to safety and security.

SOURCE: AMEY, 2014, A38 tunnel refurbishment – transport mitigation strategy. *Institution of Civil Engineers Consultants File 2014*, page 38.

### **New railway tunnels for Germany**

Those who have travelled by long-distance day trains in Germany will be familiar with the service offered by DB, including the punctuality of trains, their freedom from 'snacking' litter and the provision of free leaflets advising passengers of arrival and departure times at stations *en route* and even departure times and platforms for all connecting services, not to mention a great deal less disruption and transfers onto rail replacement bus services on account of engineering work.

Part of this success story is because Germany's equivalent to Network Rail is creating a number of new tunnels to replace older ones, a more cost-effective approach than line closures and prolonged repair works to older ones. When the new tunnels are complete their older equivalents will then be repaired and reopened, leading eventually to increased line capacity.

At Cochem in the Moselle valley the Kaiser Wilhelm tunnel (built in 1877 and until 1988 Germany's longest



tunnel at 4205 metres) has been duplicated by a new tunnel of 4242 metres alongside it on its east side. This was opened to traffic on 7 April 2014, and the older bore closed for refurbishment, and due to reopen in 2016. Eight cross passages linking the old and new tunnels are to be provided for access and emergencies.

South of Fulda on the main line to Frankfurt / Main the 3573 metre Schlüstermer tunnel has been doubled by the construction a parallel 3995 metre bore, opened in 2011. The two tunnels are now converted to single track, thus allowing a very generous loading gauge capable of taking wider and / or faster trains.

On a non-electrified line from Kassel to Wolfhagen / Korbach a new 935 metre tunnel is to replace the existing 814 metre Zierenberger tunnel between Furstenwald and Zierenberg by 2018.

From Frankfurt / Main to Nuremberg a new seven kilometre line is being built to by-pass an existing steeply graded section 6.9 kilometre route over the Spessart hills between Laufach and Heigenbrücken. The new line, with three new tunnels, will allow maximum speeds of almost twice those currently in force. Work on the new line commenced in 2012, with the new 2.6 kilometre Falkenburg under construction since 2013. When this new line opens in 2017 the old one will be taken out of use and the old 926 metre Schwarzkopf tunnel of 1854 filled in, the portals however being preserved as listed monuments.

At Stuttgart in Baden Württemberg tunnelling is in progress under the city-centre station, and at Rastatt in the same state a 4.27 kilometre tunnel is being driven under the town, to increase line capacity and train speeds. SOURCE: ANON, 2014, New tunnels galore for DB Netze. *Modern Railways* 71(791), 81 – 82.

### **Icelandic ice tunnel to open in 2015**

Construction of a five hundred metre long tunnel into Langjökull Glacier, Iceland's second largest ice cap, is well on its way. The idea is the brainchild of the various travel companies operating on Langjökull Glacier.

Ice-tunnels such as this have been constructed in a number of places around the world, but none into an ice cap the size of Langjökull. The construction means visitors will have a new and totally different view of the glacier and the impact global warming has on the environment. The tunnel will consist of numerous nooks and dens which will house exhibitions, information, restaurants and even a small chapel for those who would like to marry deep within an ice cap.

The project is owned by the investment company Landsbréf Icelandic Tourism Fund but preparations are in the hands of Efla Engineer's Office in cooperation with Borgarbyggð Community and land owners on the west coast of Iceland, glaciologists from the National University, the Icelandic Meteorological Office as well as numerous other government institutes.



The tunnel, which is located on the west side of Langjökull, 1260 metres above sea level, is expected to attract around thirty thousand visitors annually. The tunnel will open for business in 2015 and will be open for eight months each year.

SOURCE: *Iceland Magazine* 3 June 2014

### **New road tunnel under Oxford City centre**

Oxford City Council has unveiled drastic plans to construct a tunnel beneath the city centre for buses, in an attempt to ease congestion.

The proposed tunnel, estimated by experts to cost over £500million, would reach from St Clements to the railway station and would involve digging beneath the High Street. The proposal, is inspired by the Metro Bus Tunnel built in Seattle in 1990, and would be used by a system of electric buses and cyclists, leaving the road above fully pedestrianised.

Another radical proposal includes building a perpendicular tunnel, running between St Giles and St Aldates. Considering the Council's transport strategy up to 2020, Councillor Hudspeth explained, "Given the sheer scale of the growth and change that lies ahead for Oxford, we have to approach things in a radical way. These are not detailed plans, they remain ideas and they remain uncoded. Some of the ideas we are looking at might seem massive in scope and cost, but other cities around the world have delivered ambitious projects to solve their transport problems. So why not Oxford?"

[Editor's Note: I'd like to see a 'perpendicular tunnel' given that it would by definition have to be vertical!]

SOURCE: *Cherwell* 24 October 2014

### **Robbers tunnel into bank vault in India**

Indian police have arrested three men suspected of robbing a bank by digging a 125-foot tunnel straight into the vault. They stole cash, jewellery and other valuables worth hundreds of thousands of dollars from a branch of the Punjab National Bank in Haryana.

The tunnel started in an empty house nearby. In one corner police found a hole in the floor two feet in diameter which dropped down into a tunnel that was used by the





robbers to enter the bank next door. Police consider it to be a very sophisticated operation digging four to five hours every day for 40 days. The robbers used iron rods and spades to dig the tunnel, and managed to leave telephone cables and water lines undamaged.

The robbery appears to be inspired by popular Bollywood film *Dhoom* which depicts a similar raid. Officials at the government-owned bank were stupefied when they

discovered the huge hole in the ground. The robbers emptied 77 of more than 350 lockers.

The body of the home-owner, who police say masterminded the raid, has been found in his car. Police say he took his life by consuming poison. It is not clear why he took his own life, although the police believe he may have done so because he feared arrest.

SOURCE *BBC News - India* 31 October 2014

## **Subterranea Britannica**

### **Notice of Annual General Meeting 2015**

**The AGM will be held on Saturday 18 April 2015,  
commencing at 10.00am  
at the Royal School of Mines, London,  
in association with the Spring Meeting**

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Documents for the AGM will be available on our website  
at [www.subbrit.org.uk](http://www.subbrit.org.uk)

at least 28 days in advance of the meeting. We will send an email  
via 'mySUBBRIT' to advise when the documents are available

Those members who have registered to receive documents by post  
will be sent them when they become available

Minutes of the AGM 2014 are printed in this issue of *Subterranea*

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### **Spring Meeting 2015**

**Saturday 18 April, commencing at 10.25am,  
Royal School of Mines, London SW7 2BP**

There will be the usual mix of interesting illustrated talks  
along with Members' contributions and a chance to  
meet and mingle with fellow enthusiasts

There is more detail on the Flyer enclosed in this magazine, with details of how  
to book – either via the website at [www.subbrit.org.uk/events](http://www.subbrit.org.uk/events) or by post

**Cost £20.00 to include a sandwich lunch**

**Please put the date in your 2015 diary now!**



# Autumn Meeting 2014 – Newcastle

Chris Rayner

The Autumn Meeting was held this year in Newcastle and, as at Liverpool two years ago, a series of visits were offered to members attending to introduce them to some of the subterranean possibilities of the city.

## Tyne Bridge tower

The first visit on the Friday before the Meeting was below main road level and so more or less qualifies as a Sub Brit site, even though it is at the same time above the level of Quayside, the road running beside the River Tyne where we all assembled on a beautifully sunny October afternoon. Our guide, Ian Ayris, Newcastle City Council's Conservation Architect gave us a brief history of Newcastle's bridges, focusing on the Tyne Bridge directly above us. Similarities with the Sydney Harbour bridge were not accidental as that had also been designed by Structural Engineers Mott, Hay & Anderson a couple of years before their Tyneside commission.



The tower at the north side of Tyne Bridge. Photo Mark Sunderland  
Ian led us to a locked door in the granite north tower of the bridge and after climbing a short dark staircase, we were in the lowest level of a very tall square room. When the bridge had been built in the 1920s (it was opened in 1928 by King George V, who christened the bridge by making its first official crossing in an Ascot Landau carriage), warehousing was still in demand along the riverside and so the granite tower interior was built in such a way that four additional upper floors of storage space could be created in extremely short order. They were never needed however and all that survives today is the skeletal steel framework.

A stair tower takes one up to an airy gangway running round above the warehouse on the highest level of steelwork. Several members with confidence in the longevity of 1920s steelwork made the circuit, disturbing a few pigeons in transit. Access to the high level roadway was also possible at this level while an adjacent defunct lift car has been turned into a store room. A steep access stair leads from here up to the plant room at the top of the tower.

## Melbourne Street Tramway Generating Station aka Manors Power Station

As we had some time before our next visit, Ian took us on a tour of some of the more offbeat highlights of the



Paul Sowen at the west end of the lowest warehouse floor of the Tyne Bridge tower riveted by its steel framing. Photo Clive Penfold

neighbourhood, including a high-level walkway that was an abandoned part of T Dan Smith's "Brasilia of the North", the remains of a two-storey air-raid shelter on a cobbled street called The Side, and a pillbox in a railway bridge. We finished all too soon at Manors Power Station in Melbourne Street, designed by the well-loved local architect Benjamin Simpson and displaying some of his characteristic flourishes such as ornate copper roof turrets and stained-glass windows depicting trams, for Simpson had no problem with celebrating the modern industrial age.

This coal-fired power station was built between 1901 and 1904 to generate electricity for various civic uses, including the city's tram system and electric arc street lighting, the Town Hall, and the new electrically powered cranes on Newcastle Quayside. The lift we had just seen at the Tyne Bridge tower would also have been supplied by it.



Power station cable duct

Ed Morrow first showed us the 18m high Turbine Hall which had originally housed the three marine-type reciprocating steam engines, two rated at 1,000 horsepower and the third 2,000 horsepower, which had





generated electricity at 500 Volts via a DC dynamo. A large switchboard at the station had then distributed power to the Newcastle Corporation Tramways system. Within five years these original turbines were obsolete and had to be replaced by four new Parsons turbo-generators hoisted into place by a massive 50 tonne beam crane which still survives, outlasting the second generation turbines by half a century. The hall had then had a chequered history, at one point in the 1960s becoming an indoor car park and later, when the city's Metro system was being built in the 1970s, the site of a full-size Metro station mock-up. Now its owners the City Church use it for their Sunday services, and also let it out for conferences and other functions.

Down below in the basement, the glazed brick plinths that the post-1909 turbo generators once sat on still remain, together with an under-pavement cable duct running the length of the building. A pile of glass pavement lights in the middle of the floor would originally have lit this now dark duct way.



Heavy blast door at the entrance to one of the air-raid shelters



Steel propping is evident in the air-raid shelter

Two wartime air-raid shelters also remain, with unusual steel propping, escape hatches and heavy blast doors. These were almost certainly shelters for the Corporation Tramways workforce as no public access appears to have been provided.

We finished our visit back in the Turbine Hall, but this time up on the gallery where we had a closer view of the crane built by the Crown Iron Works in Manchester.

### The day meeting

The Saturday Day Meeting was held at the Mining Institute in Neville Hall and members were able to enjoy napping in the semi-circular lecture hall, modelled on the Royal Institution in London, and then feasting on home-made cakes in the spectacular Wood Memorial Library. An unexpected bonus though was a tour of the building after the meeting, which came about when several members found out that the basement had been used as a wartime air-raid shelter.

First we were given a short introduction to the history of the building, which was built in 1871 by the North of England Institute of Mining and Mechanical Engineers, a group that had been formed in 1852 to try to improve their industry's safety record after recent disasters and who were in search of engineering solutions. For a time it had also been home to the College of Physical Science, the forerunner of today's Newcastle University.



Nicholas Wood looks down approvingly on the Sub Brit lunch in the Wood Memorial Hall

Our interest whetted, we were taken first of all to the basement store room where the wartime steel strutting remained from its time as an air-raid shelter for the building's occupants. The old cellars were next on the agenda, reached from a small doorway adjacent, then upstairs to the former board room used by the building's many owners, which had included the North Eastern Railway Company, the Newcastle Stock Exchange, the National Coal Board, and the Freemasons Provincial Grand Lodge of Northumberland. Further up in the building we entered the ceremonial and robing rooms formerly used by the Masons, and it was noticed that several members automatically began to roll up their trouser legs. Final stop in the tour were the library's vaults, accessed via a steep spiral stair.

### Grainger Market Air-Raid Shelter

Not long after sunrise on Sunday morning a pack of bleary-eyed Sub Britters, some still suffering from their Saturday night excesses, gathered together outside the entrance to the Grainger Market. This was closed for cleaning though not to us, and so we were able to enjoy the architecture of this 1835 building. We headed for the old vegetable market on the west side where an air-raid

shelter beneath the open hall had been specially opened up for us by the City Council's market staff.

This shelter was unusual in being particularly intact, retaining not just benches and gas curtain frames, but also the original hessian modesty curtains in front of the chemical toilet recesses. Part of a sign dated 1942 remained on two sections of timber boarding, possibly the remains of a noticeboard or timber door. Phil Catling meanwhile found a roll of doped hessian stiffened with timber battens, the remains of a gas curtain.



Benches still in place in the Grainger Market shelter. Note the wooden framework for a gas curtain on the right.



Hessian curtains provided a modicum of privacy for those using the toilet recesses.

The shelter was lined with precast concrete wall and roof panels, later stiffened with steel angle strapping, however traces of an older brick barrel-vaulted roof could be seen at certain points, into which the concrete linings appeared to have been set. Through a small hole in a wall forming the south end of their shelter, the same kind of vaulting could be seen running away beyond the confines of the Market. It has been said that these run down to the central station and that there are other tunnels under the rest of the market. An unsolved question though is why, if there was an earlier brick tunnel into which the wartime precast concrete lining was set, it had regular blast offsets. Clearly a mystery that needs further study.

### Victoria Tunnel

Members split up into three groups to visit the Victoria Tunnel, originally built in 1842 as a 3.6km long underground wagon way from the Spital Tongues colliery down to riverside docks at Ouseburn. The coal-laden

wagons would be allowed to run down to the river under gravity and would then be hauled back up empty, originally using ropes and then later with steel cables. Our guides recounted the tragic story of an accident in 1852 when the fail-safe system doubly failed and surveyors walked up the tunnel without getting clearance from the up-tunnel colliery. At the same time, the colliery sent down some empty coal wagons and for once the wagon brakeman failed to jump on at the rear. On the day of our visit, the visitor-experience sound effects weren't working and Sub Britters thankfully had to use their imagination to recreate the thundering clatter of approaching coal wagons. The tunnel had no refuges for the three men to press into, and so each made a different split-second decision. To run, to press oneself against the side wall, or to lie down in the middle of the tracks. The outcome was predictable, it was far too far to run and the surveyor who tried was killed, while the wall hugger suffered terrible injuries, and the man who lay down on the tracks escaped without injury.



The Victoria Tunnel

The stone walled and brick arched tunnel was altered during its conversion to an air-raid shelter in 1939 when the tunnel location had first to be rediscovered and then seven new protected entrances had to be built. The walls were whitewashed, lighting was installed, seats provided and chemical toilets installed at regular intervals, traces of whose fixing mortar could still be seen. Blast walls were erected to break the tunnel down into smaller sub-shelters, several of which at the south end of the tunnel had to be negotiated and we marvelled at the yogic skills of the post-war cyclists who had used the Tunnel as a short cut. More yogic manoeuvres were required as a sound crew had left piles of equipment at various points which had to be carefully navigated around. Nevertheless the visit was excellent and included a climb up to one of the wartime entrances at Claremont Street and a brief excursion into the off-limits part of the tunnel. More details about the tunnel's history are in *Subterranea* no. 32.

### Ouseburn Culvert

While this wasn't on the Visits Programme, a number of people walked up the valley from the Victoria Tunnel to look at the Ouseburn Culvert entrance, and some Sub





Britters even visited at their own heed the air-raid shelter section inside.

The Ouseburn Culvert provides an interesting counterpoint to the Victoria Tunnel, for while the latter had been described at the time as the worst shelter in Britain, the Ouseburn was considered by some one of the best, due to its dryness, facilities, the sense of camaraderie due to its size, and of course the level of protection afforded.



The air-raid shelter in the Ouseburn Culvert

Interesting finds were the shelter bay numbers painted on the walls, and glass “tell-tales” fixed across roof cracks with wartime dates inscribed on the mortar. The latter show that it was being regularly monitored to ensure its safety, possibly after bomb impacts on parts of the city above. The Ouseburn Culvert was also covered in detail in *Subterranea 32*.

### Metro and Tyne Tunnel Control Centres

Visit to the two control centres had to be rationed out for operational reasons, as both the Metro and Tyne Tunnel are 24/7 operations and access had been generously granted by both operators.

The Tyne and Wear Metro still looks very smart even now it is 34 years old. True to its name, it serves not only the Newcastle conurbation but even stretches out to neighbouring Sunderland. Described as Britain’s first modern light rail system and just over 46 miles long, it’s still the largest metro system in the country after the London Underground. The construction of new city centre tunnels included the discovery of 15th-century bell pits and required old coal pits to be filled and newly discovered coal seams to be mined during the excavation process. The Victoria Tunnel had to be strengthened where the Metro tunnels ran above it, while the imposing 40m high Grey’s Monument, built in honour of the great reforming Whig Prime Minister and tea drinker, was found to be lacking foundations when Monument Station was built and had to be underpinned.

Today the system is operated by DB Regio Tyne & Wear, a subsidiary of Deutsche Bahn and part of Arriva UK Trains, on behalf of Nexus. Sub Britters visiting the South Gosforth control room were given an almost hands-on introduction on how to run a rapid transit system.



The Metro Control Centre at South Gosforth.  
Photo Llangollen Signalman

Train drivers can set their own routes from their cabs using code numbers for the route they intend to take, and once this code is entered, the train follows this route and transponders triggered by the train inform the Control Room of its position and automatically change points and signals at key stages on its journey. The Control Room staff monitor all the trains from this board. Generally the signals are automatic, but when there is an incident these can be overridden by the controller who can set individual points and signals.

The power control board meanwhile monitors the electrical systems of the whole of the Metro network, including station lighting, ticket machines, fire alarms, and PA systems.

Another control panel provides passenger information, and a couple of controllers monitor the Metro’s 600 CCTV cameras and respond to calls from passenger help points on stations and on the trains, connecting through to police and other emergency services. The CCTV system is also monitored by relevant Local Authority monitoring centres as a back-up in case Control Room staff miss anything.



Sub Brit members inside the Tyne Tunnel Silver Room  
(the command room for the emergency services)  
watching the control room CCTV video wall

At the same time, the other group visiting the Tyne Tunnel control centre learned from their guide George Briggs of some of the challenges of operating a river tunnel crossing, not least the attempts to persuade

stubborn Geordies that they really don't want to drive down the tunnels in the wrong direction. Sub Britters visited the Silver Room, used by the emergency services, and watched the control room in operation. Acronyms abounded as George explained how various elements like the VAID (Video Automatic Incident Detection system) and SCADA (Supervisory Control and Data Acquisition system) meshed together to give one of the most integrated transportation management systems of its time in the world.

George described how the original 1.7km tunnel cost £12.5 million to build in 1961, whereas the 2011 tunnel cost £260 million for a 1.5km tunnel. The four river sections of the new tunnel were assembled in a dry dock and lowered into a prepared trench on the river bed, while the adjacent land sections were formed by cut and cover.



Inside the newly-built narrow escape gallery in the northbound Tyne Tunnel as traffic streaks by beyond the green emergency doors. The escape distance sign is in yards as tunnel speeds are in miles per hour

Hi-vis jackets were then donned to walk down into the emergency gallery running alongside the original northbound tunnel. This was only built in 2011 when, following the opening of the new tunnel, the original tunnel could be taken out of service temporarily and slightly reduced in width. At the same time a state of the art ventilation system was installed to provide clean air for safe evacuation in the event of a fire. Should there be a fire, a high pressure mist system delivers enormous quantities of fine water mist to cool, reduce and prevent the spread of fire. Smoke meanwhile, and in non-fire situations, airborne pollution, is designed to flow in the direction of traffic so that those trapped behind the incident can escape in relative safety. The escape galleries have a dedicated ventilation system which will provide fresh air at a higher pressure than that in the tunnel to prevent fumes entering the gallery through open escape gallery doors, which are situated every 100m along the tunnel. A highlight of the journey back from the northbound tunnel to the control room was stopping the vehicles at the tolls and then walking very slowly across the road.

### Jesmond Dene ARP Control Tunnels

Lunchtime guests at the highly rated Jesmond Dene Hotel looked somewhat surprised to find the car park full of Sub Britters as we gathered for the next visit to the wartime ARP control centre (described in *Subterranea* no. 32). General manager Scott Davidson was very obliging though and led us through to the kitchen where there are many stairs down into the dark vaulted cellars. These were concrete finished in the war but it is likely that there were earlier cellars or tunnels present relating to the original house, as a quick way of gaining access to the dene.



The Jesmond Dene tunnels

Like true explorers we left only footprints, indeed a large number of muddy ones, as we came back up into the kitchen and out into the sunshine. Members then went down into the wooded dene to look at the blocked-off tunnel entrances and the renowned brick pillbox that guarded the tunnel entrances.

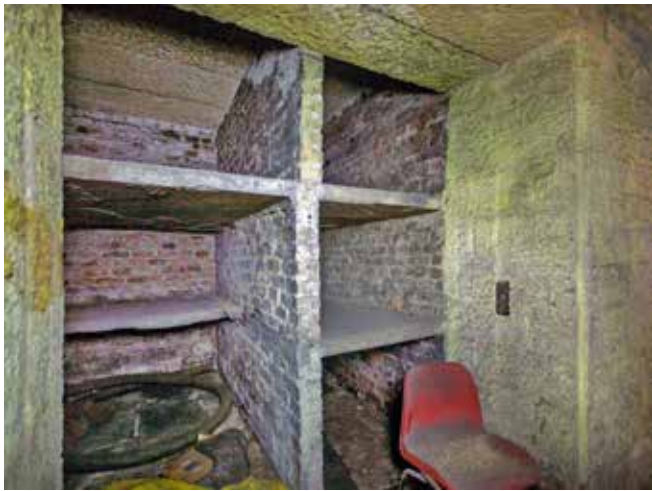
### Jesmond Old Cemetery Catacombs

The final visit of the weekend was nearby on Jesmond Road, where Richard Hollinshead had opened the catacombs under the chapels at the Cemetery entrance, which was built in 1835. Catacombs were not uncommon in early Victorian cemeteries. The two chapels either side of the arched entrance are respectively Church of England and non-conformist, but death appears to ignore such differences and so below the ground the catacombs connect to one another.

Although there are coffin recesses, 22 in total identified by Roman numerals, these are empty as it seems that they were for the temporary storage of coffins prior to burial rather than permanent storage. One theory runs that this temporary storage allowed decomposition to start and so deterred Geordie body snatchers. Other underground temporary coffin stores have been found in cemeteries in Nottingham and York, the latter of which is believed to have been built for victims of the wartime blitz who would be interred in a more dignified way once hostilities were over.







Coffin recesses in one of the catacombs

During the war it is believed that the Jesmond catacombs were used as a public air-raid shelter or even temporary accommodation for those bombed out of their homes, which may have seen the coffin recesses being reused as bunks.

And so ended a very enjoyable weekend, thanks to our many site hosts who had been so generous with their time and in allowing access to some exceptional sites.

Photos Chris Rayner unless stated

## Lochaline Silica Sand Mine in Argyll to reopen

The reopening of the silica sand mine at Lochaline has been reported. The mine workings cover around 370 acres accessed by around 48 km of tunnels, lying under 150 metres of basalt. The Lochaline sand is amongst the highest quality available in the UK – 98.8 percent quartz with a grain size ranging from 100 – 500 microns and with almost negligible impurities. The position of the mine – on the shores of the Sound of Mull with the facility for



Adit 1. Photo Michael Jagger

direct shipping out – is another commercial advantage. When the mine was closed in 2008 by its former owners Tarmac, eleven jobs were lost – six underground and five surface posts. It is now being sold to a joint venture comprising the international NSG Group (whose UK identity is Pilkington Glass) with Gruppo Minerali Maffet, an Italian mining company.

The high-quality silica sand at Lochaline is destined for use in the production of solar glass panels and the new owners expect something a production life of over ten years from the mine. The plan is to have the mine ready to reopen in April 2012, shipping out 100,000 tons per annum to St Helens in Merseyside, for specialist glass production there.

In the 1920s the Edinburgh Geological Survey did an analysis of a Lochaline sand sample – returning a result

of 99.69 percent silica. But at that time imported silica sand was quite cheap and Lochaline's remoteness made the overall cost of extraction uneconomic. What changed the fortunes of the mine was the outbreak of World War II and the sudden need for high-quality optical glass for military instruments and gun sights and for chemically resistant laboratory glass.

By 1940, under Charles Tennant & Co from Glasgow, management and staff were on site, with some of the necessary equipment brought to Lochaline from the legendary slate quarries at Ballachulish which Tennant also owned. The impact of the needs of war had reduced production at Ballachulish so some of its gear met this other useful purpose, away to the west, across Loch Linnhe at Lochaline. By 1945 the mine had produced some 35,000 tons of silica sand.



Adit 7

And today, in the Autumn of 2011, that same firm, now part of NSG Group, is renewing its relationship with the Lochaline mine, as it starts up for a second time. An indication of the differences in working practices between then and now comes from comparing the anticipated production output under Pilkington's from April 2010 – 100,000 tons per annum.

SOURCE: [www.forargyll.com](http://www.forargyll.com) website, 15 October 2011.





# Barnton Quarry Bunker Restoration – Progress Report

## Grant More



Looking down into the R4 plant room. This is during our clear-out. Bottom left you can see the temporary recirculation fans that we've fitted to provide air circulation while we work. We'll be restoring the main air fan (centre) as part of the project

It's been two years since we published our last project update in *Subterranea*, and a lot has been accomplished in the interim!

### The Plan

To recap, the project is split into three phases. 1: recover the grounds, 2: recover the buildings and 3: refit the buildings. We've completed phase 1 and we have nearly completed phase 2. In a few months we'll be halfway through the 7-year project and ready to start refitting the bunker!

The project has two full-time staff and a huge team of like-minded volunteers, including many who are Sub Brit members! We have been astounded by the public interest which we've received and the response from those willing to regularly give up their time to restore this historic building. Volunteers are the lifeblood of what we're doing and carry out the bulk of the work. We are suitably funded and laser-focused on completing the project.

### The Site

Those that know the site will know that 30 years of neglect had left the 12.5 acre site in a badly overgrown, derelict and fly-tipped condition. Phase 1 thus took us nearly 12 months and involved moving over 1600 tons of rubble from the car park. We cut down and disposed of over 200 mature trees, including a clear-fell of 2.5

acres on top of the R4. At one point we had nearly 30 volunteers working in large teams to clear the trees and vegetation. We're now fully clear and back in business! We sold most of the wood to local woodburner owners, in line with our zero-waste, maximum recycling policy and pumped the cash back into the project. All metal from the project is also recycled in the same way.



This is the top of the R4 after the first round of felling. We clear-felled everything on top and around the bunker and recovered the grounds. This view is looking north towards the Firth of Forth

We glass blasted the graffiti from the outside of the buildings to reveal beautiful red brick. We've got new windows ready to be installed in the guard room and will be fitting these shortly.







Front of the guardhouse looking good after a first pass with the media blaster. We have new windows ready to fit to the building

### Services

A key part of this phase was the recovery and installation of the site services.

We recovered the original clifftop water tanks, sterilised them and installed new water pipes. After much discussion with the local water board, we've recently been reconnected to the mains water supply.



On a sunny day in May 2014 we capped the SOC sewerage pit. This is three of our volunteers riveting the troughing together before we fitted high-tensile steel reinforcement mesh and poured the concrete

We dug over 5 tons of rubble out of the SOC sewage tanks. We then designed, built and installed a new state-of-the-art sewage scheme to replace the original sewage ejector (which was sadly beyond economic repair). We jetted over 200m of 4" pipe so that we've got a clear run to the sewer. We capped the sewage pit with an RSJ-supported reinforced concrete cap, custom-made by the team.

We found and cleared the original GPO cable ducts and pulled a cable bundle into the bunker from the local telephone exchange. We now have high-bandwidth data in the bunker (indeed we've got fibre-optic links between the buildings now!) and working phone lines.

Security has been foremost in our plans, so we've built new site gates and installed comprehensive gas discharge lights and security cameras across the site. We have 24-hour on-site security.

Power supplies to the site were cut in the early 1990s

after the fire and the cables have been subsequently re-purposed for local cellphone masts, so we installed a temporary single-phase building supply and treated our new generator to a full overhaul and rebuild.



Incomer room. We cleaned and lined this room, digging out all the ducts, pulling in plastic liners and fitting cable trays. This picture shows the bunker being supplied on-load from the generator. The panel in the centre is the generator control panel and the power change-over unit. The panel on the right is the master distribution panel with circuits for each of the building areas. The power supply company switchgear for the permanent 3-phase supply will be fitted to the left of the master distribution panel

We recovered the incomer room from derelict to fully functional. The main power panel is installed, the 3-phase generator control panel is live and powering the R4 and the building is ready to take the 3-phase mains from the power company, which will be installed later next year.

### WWII Sector Operations Centre

We then set about replacing 1400m<sup>2</sup> of roof covering on the WWII SOC. We hand-mixed and applied over 60 tons of waterproof bonding screed and then applied two coats of a specialist liquid vapourproof membrane. It forms a solid rubber mat which is highly waterproof! We're planning to use the rainwater to feed the sanitary facilities, minimising our water consumption! We'll be adding a durable roofing matting over the top to double-check the waterproofing and give us a 50-year guarantee on the water-tightness.



SOC is watertight with the new roof covering. Here you can see the standing water on top of the building. This picture also shows the extensive felling which we've done and the clearance of the car park at the top right of the picture





## Workshop

We built and kitted-out our new workshop complete with fabrication facilities, including lathes, milling machines and a state-of-the-art CNC manufacturing machine. We'll be using this to fabricate parts for the bunker as we fit it out. We also added plant to our equipment complement with a new 4x4 dumper and a Mule tractor for shuttle runs up and down the tunnel into the bunker.

## The Bunker

We then turned our attention to the bunker. Firstly, we recovered the tunnel and repaired the render, finishing with four coats of sprayed masonry paint as a scratch coat of white while we work. Much of the woodwork was damaged, so we removed it all, installed new wood, added cable trays and then pulled in the main permanent 200m steel-wire armoured power cable (weighing over half a ton) into the R4.



The top floor of the R4 operations room in 2001 showing the damage caused by the fire. Before the fire the well has been floored over with timber. Photo Nick Catford



Tunnel after a good sweep and steam-clean. We lifted all the lino! We'll be respraying the concrete lining on the cast tunnel segments and painting the concrete. We were surprised how intact the tunnel was under the soot!



R4 operations room, top floor after the clear-out. Lights are on; ventilation system is connected and operating. Scaffolding has been fitted around the ops well. This area is currently being glass blasted back to the bare metal and concrete, ready for refit

All the duct covers in the tunnel had been stolen, burnt or smashed so we spent a considerable time remaking the tunnel duct flooring to the original specifications. We've now got a complete and level floor that is structural, complete and removable right into the R4.

In the R4 bunker, we started off with the installation of a comprehensive, transformer-isolated 110V supply and then installed 120 construction site strip lights and the necessary wiring. The bunker is now fully lit.

One of the key areas for the clearout has been the stairwell winch and its associated mounts. Unfortunately, the original RSJ beam and the winch was badly damaged in the 1993 fire, so we commissioned an identical new RSJ and had it installed and certified to 2t SWL, along with a new winch. This has proved indispensable as we've



Fitting the main power cable for the R4 in the recovered tunnel. We've refitted the tunnel with new wood and cable tray to take the SWA cable. We'll be refitting the original ROTOR hooks on the new wood on the opposite side of the tunnel once we've restored them





been hauling tons of debris from the bottom floor of the building.

Clean air is vital while we work, so we connected a bank of modern high-pressure fans to the smoke extraction system to back-feed the main air supply (the duct from the original air intake fan has been cut, we'll be manufacturing a new one shortly) and adding another bank of fans to draw air down the tunnel, exhausting through the back air intake. In addition, we've installed a number of industrial air management units that heat the bunker to avoid formation of condensation. We now have a most acceptable working environment with light, clean air and heat!

We scaffolded the exposed edges of the operations well to allow us to work safely. The top floor of the operations well is about to be floored over so that we can glass blast the internal ceiling.

With that we cleared the entire R4. Over a period of about 3 months we removed all the debris from the bunker. We hand-sifted through all the debris to ensure we preserved everything we could.

Under the standard RSG issue 1960s lino we found the remains of the solid teak RAF R4 operations room floor. It was heartbreaking to see small sections of what the floor would have looked like. However, we've secured budget in our plan to replace the floor with solid teak exactly as it was. Expect this to be back to its former gleaming glory soon!

Also in the debris we found beautiful, undamaged original ROTOR signage, parts of the original R4 operations room plotting table (it had been cut up and used as a backing for a key cabinet!) and virgin parts for the air-conditioning system. We've carefully preserved these and will be using these in the restoration. We have removed a huge number of fragments of the original 13mm thick glass from the operations well. It would appear that the ROTOR operations well glass was all in-situ behind the RSG stud walls. Sadly, it's all smashed. We'll be replacing it all with a modern equivalent as we rebuild the operations well.

### **Next Phase**

We've bought a large-scale commercial media blasting rig and the next phase of the project is to glass blast the interior of the building back to the bare concrete and metal. We'll be spending the next 5 months blasting the building and then it's on to the refit. We'll literally be starting the refit from scratch.

We'll be stripping back the internal ceiling (troughing) to bare metal, applying a state-of-the-art protective coating

and then spraying concrete to produce an as-new finish that is identical to the original ROTOR ceiling. We'll be removing the RSG-period frame soon after, giving us the only open R4 operations well in the world.

The restoration team is serious about restoration accuracy and the lengths that the team will go to are impressive! For example, we remade the original outer blast doors at the rear of the building. They were cut from their hinges by the fire brigade in 1993 for emergency access. We remade the hinges from scratch (lots of welding and grinding) and rehung the doors. They're currently awaiting media blasting and a fresh coat of paint. Good as new!

### **Vision for the future**

We are very serious about completing the project to the highest standards and our vision is to restore as accurately as we can to the original R4 configuration.



This photo of the R4 at Kelvedon Hatch is what we are hoping to achieve at Barnton

Our vision and goal is to replicate the R4 operations well, the tote, map table and the associated control cabins. We'll also be restoring the rest of the building back to how it was in the 1950s in order to create exhibition space and to secure the future of the building as a museum and education centre.

### **Can you help?**

We will achieve our goal with vision, determination and tenacity! But some parts of the building simply can't be restored with determination, either because it's economically unviable to remake the parts or because we don't know what the parts were.

We're massively keen for Sub Brit members to help us out. Volunteers are always welcome and we're always happy to run site tours for those who come on-site to help out. We also need knowledge. The specific things we need help with are: R4 tote layout. Does anyone have pictures? We need to know what it looked like. We've



got the original plans for the construction of the tote, but what did it display? We want to recreate it as accurately as we can. Seeing as there aren't any R4 totes for us to look at, it's going to rely on someone's knowledge. Please help us out if you have some!

Locating a pair of front blast doors. We've got four of the original six, but the two from the bottom of the access tunnel are missing. Do you know where we can find a set?

Telephone exchange equipment. We're looking for any PBX3 equipment, equipment frames, cabling and rack units, specifically type 51 to replace the equipment we had in the GPO room. We had a lot of gear and we not only want to replace it, we want to get as much of it working as we can. Can you help us? We'll travel to collect anything on offer and take any help!

Plant room equipment. We're looking for compressors, tube condensers and pipework. We know the R4 bunkers shared plant with the PR1 protected repeater stations. Does anyone know where else we can find surviving examples of the original plant made by L. Stearne and Co? We're happy to go scavenge and preserve from other



GPO equipment room. This is sadly the sum total of what was left when we cleared the room. The room is completely clear now, all the lino is up and it's ready for restoration.

The RAF kindly helped us out with a donation of shelving to help us organize the restoration

derelict sites with permission. Do you know anyone who can help us get access to the right kit?

Feel free to drop me a line at [grant@barntonquarry.org.uk](mailto:grant@barntonquarry.org.uk) if you'd like to get involved or you can help us out, it would be great to hear from you.

## Original WWII air-raid shelter to be protected and restored

**Location: St Leonard's Court, Palmers Road, East Sheen, London SW14**  
**Cathy Blake**

### Introduction

Hidden under the grassy lawn in front of peaceful St Leonard's Court, close to Mortlake Station in southwest London, is a World War II air-raid shelter in original condition. It was built concurrently with or very soon after the flats which were constructed in 1938 by local builder Mr F G Fox, and accommodated 48 people, approximately half the number of the flats' occupants.

Beneath the brick-turreted entrance building, narrow steps lead down to separate male and female day rooms, fitted with bench seats and chemical toilets, and two sleeping areas with triple-tiered bunks, each with its individual lamp holder, hooks and hand-painted numeral. Heating was basic, in the form of a cast-iron stove, and metal rungs on the end walls provided the only route for emergency escape.



Entrance to the Shelter



The shelter itself is elaborately planned and detailed compared to the norm at the time. It is unusual to have, for example, individual accommodation, a stove in an underground shelter, and rare to have an electricity supply, let alone one serving individual compartments.

### The air-raid shelter today

The shelter remains as it was left in 1945. It had protected residents from the Blitz in 1940–41, V-1 flying bombs in 1944 and then V-2s in 1944–45. Although one resident said it was so uncomfortable that he preferred to risk death in his own bed in his flat, there remain hooks for clothes, shelf rests for bunks, lavatories, hard hats, and various nooks and crannies used for the storage of minimal possessions needed for an overnight stay.

### Protecting our heritage

The first application was made to English Heritage for statutory listing of the air-raid shelter in 2006, which







One of the numbered sleeping bays with a shelf and a light provided for each of the three bunks

unfortunately was declined. However, following the revised guidance in *Planning Policy Guidance 16: Archaeology and Planning in Communities, Local Government Circular 01/2007: Revisions to principles of selection for listed buildings* published in March 2007, and English Heritage's *Military Selection Guide*, a request was submitted in May 2008 by Environment Trust for Richmond-upon-Thames for reopening the case for statutory listing. The case was successful and the shelter was recommended for Grade II listing on 23 July 2009 under the Planning (Listed Buildings and Conservation Areas) Act 1990. The reasons for the Grade II designation decision by the Secretary of State in consultation with English Heritage were as follows:

- It was built to a high specification providing individual accommodation above the normal government-led standard;
- Unusually, most of its fittings survive to give a clear impression of how the shelter was used;
- Unusually for an air-raid shelter, it is incorporated within the landscaped setting of a contemporary block of flats, St Leonard's Court.

The shelter has since been added to English Heritage's "At Risk" register as the building is in slow decay with no agreed solution.

### Proposed restoration

The St Leonard's Court residents confirmed that the majority would be happy for a project to restore the air-raid shelter to be set up for the purposes of bringing visitors and school groups to see it by appointment. This is a unique chance to bring to life an everyday experience of the Second World War in London and its restoration will be a marvellous opportunity to bring history alive for them.

A steering group has been set up consisting of local residents, members of local history and amenity societies, mentored by the Environment Trust. We have commissioned a number of surveys of the building before investigating potential funds for its restoration and for an education programme to be run within it. A meeting with the Imperial War Museum's Education Officer has confirmed our belief that it would make a wonderful resource for schools exploring the Home Front as part of World War II studies and several local schools have expressed enthusiasm for the project.

An interpretation board was erected in April 2013, funded by the Civic Trust, to give more information on the historic past underfoot.

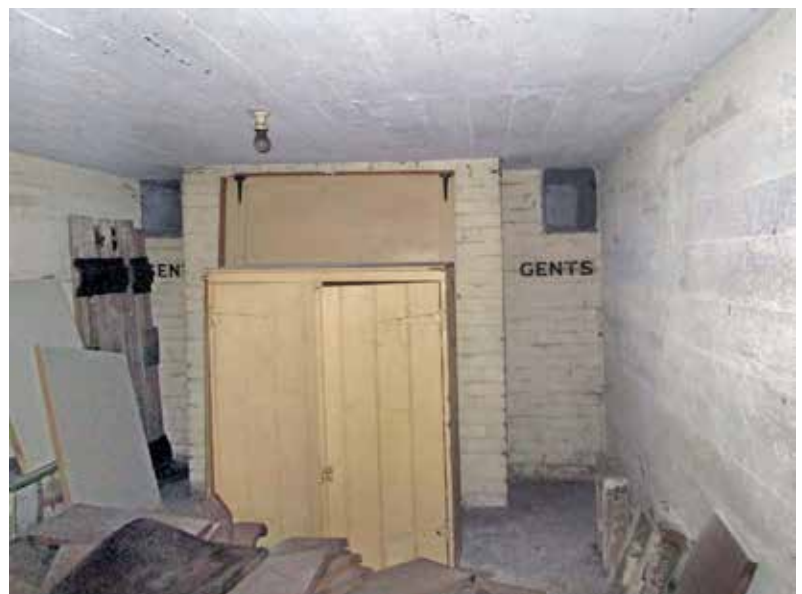
### The Steering Group

- Barnes and Mortlake History Society
- Environment Trust
- Mortlake with East Sheen Society
- St Leonard's Court Residents' Association

**Cathy Blake is Heritage Project Manager for the Environment Trust**

**Editor's note:** This unique shelter was first described in *Subterranea* 16 (April 2008).

Photos Cathy Blake



Toilets were provided at each of the day rooms with two recesses behind the wall still containing their Elsan chemical toilets. Between the two recesses a steel ladder leads up to an emergency escape hatch in the ceiling.

# Unusual ROC Posts

Nick Catford



Inside the Windsor ROC Post. Obs. Cdr. Ballington, the Group Commander is on the left.

Note FSM probe cover on an extension pipe at the rear. Photo Bob Pickwood

By the mid-1950s, the greater speeds and altitudes attained by jet aircraft combined with the improved performance of radar led to a reduced requirement on the part of the RAF for the services of the Royal Observer Corps (ROC) in tracking aircraft. However, to compensate for a reduced role with regard to aircraft, an additional role for the ROC, in the form of defending against the effects of nuclear weapons, was announced in June 1955.

In order to take on this new role the Home Office had to provide new underground bunkers which would protect the four-man (later three-man) crew from blast and fallout for a week. The new posts would be fitted with a range of equipment for monitoring the position and magnitude of atomic weapons detonated during an attack. This data would be used by the United Kingdom Warning and Monitoring Organisation (UKWMO), in conjunction with weather information provided by the Meteorological Office, to produce a forecast of radioactive fallout. Fallout would be monitored as and where it occurred, with its actual location and strength mapped using data obtained from instrumentation at ROC posts. Such information when combined with ROCMet, (data concerning actual wind speed and direction obtained from cluster

Master Posts equipped with wind anemometers and other basic meteorological instruments), would permit the dissemination of accurate forecasts predicting the distribution and strength of nuclear fallout.

The minimum area required for the new monitoring posts was a circle 50ft in diameter on flat ground without obstruction. This ruled out many of the existing post sites, some of which were on top of buildings; these were ideal for aircraft observation but totally unsuitable for the Corps' new role.

A prototype underground post was built at Farnham in Surrey with the first trials taking place there on 29/30 September 1956. The bunker consisted of a reinforced concrete box further protected by a 7 1/2" concrete cap. The bunker was accessed by a 15' shaft. At the bottom of the shaft there were two doors, one opening into a small recess that contained a chemical toilet and the other was the 15' x 7'6" monitoring room.

Once the prototype post at Farnham had been approved the same design was used for nearly all the 1563 underground posts that would be built between 1956 and 1968. The posts were built by local contractors who would generally be awarded the contract to construct a batch of posts all to a standard pattern. There were some





local differences on the surface, usually relating to the positioning of the GZI but underground the 'boxes' were, or should have been, identical. At some sites the posts were built back to front. According to the construction plans anyone climbing down the ladder would step to their left into the monitoring room. A few posts were built back to front and people climbing down the ladder would step to the right to enter the monitoring room. This was a mistake by the contractor but as it really didn't make any difference they were left as built. Two examples of reversed posts are at Week St. Mary in Cornwall and Alford in Lincolnshire. In west Wales a batch of posts were built the wrong way round.

While most posts were provided with the standard underground bunker, three posts utilised existing buildings.

### Southsea

The post at Southsea was built inside an underground ammunition magazine. The Elizabethan fortifications around Portsmouth were remodelled by Dutch engineer Sir Bernard de Gomme between 1665-8. One of these fortifications was Wimbledon's Bastion (later known as King's Bastion) at Southsea which included Spur Redoubt and a section of curtain wall (a defensive wall) known as Long Curtain. The guns on the Long Curtain last saw active use during WWII.

During the war the Southsea ROC post was initially on the roof of the Royal Beach Hotel opening in January 1940 and remaining operational until November 1946. With the postwar reactivation of the ROC a new post was brought into use on the roof of Commercial Chambers in September 1947.



The surviving gun emplacements on the Long Curtain.  
The Southsea post was located between two emplacements.  
Photo Nick Catford

When the role of the ROC changed to nuclear monitoring a new underground site was required. The site chosen was one of the underground magazines on the Long Curtain. The magazine originally served two of the gun emplacements and was located between them. The access shaft was a little deeper than the standard 15 feet and rather than protruding above the ground, the access

hatch was flush with the ground. Other surface features including the vent shaft protruded above ground as with the standard post. The new Southsea post opened in August 1961 but was short lived. In 1968 the Labour Government spending cuts saw the disbanding of the Auxiliary Fire Service, the Civil Defence Corps and some elements of the Territorial Army and Volunteer Reserve. The ROC was reduced in size to 873 underground posts and Southsea was one of the casualties.

After closure all surface evidence of the post was quickly removed and the access shaft was infilled and grassed over. The gun emplacements can still be seen but there is no evidence that the underground post ever existed.

### Clacton

The Holland-on-Sea post in Essex opened in 1938 on the roof of the telephone exchange where it remained operational throughout the war. With the postwar reactivation of the ROC, a new post was located in the clock tower on the roof of the Alton Hall Hotel coming on line in June 1950. When a new site was required for nuclear monitoring the site selected was the lower room of Martello tower D, on the edge of the Clacton golf course, one of 26 towers built along the east coast between St. Osyth and Alderton



The Martello tower on the edge of Clacton golf course.  
The aircraft observation post is seen on the roof

The East Coast towers were built larger and more heavily armed than the South Coast towers with walls that were 8 – 10 feet thick, as a defence against the larger ships that the French might have used if they had chosen the East Coast as the invasion point. The tower was built between 1808 – 1812 and the garrison was stationed at Weeley barracks. When no longer required the tower was sold by the government in 1904 to the West Clacton Estate. As the tower was some distance from Holland-on-Sea the post was renamed Clacton. The post opened in December 1961. Unusually it had two FSM pipes protruding from the walls a few feet off the ground; one was on the west side and the other on the east side of the tower. The GZI was mounted on the roof. The Clacton post also fell foul



One of the two FSM pipes protruding from the tower wall.  
Photo Mark Russell

of the 1968 defence cuts closing in October that year. The entrance on the north side of the tower was quickly bricked up but the two FSM pipes can still be seen. The tower is adjacent to the coast path which runs along the top of the sea wall.

### Windsor

The Windsor post opened late in the war in August 1943. It was sited on the Brunswick Tower at Windsor Castle. It was also late going underground not opening until September 1967, one of the last 'underground' posts to be opened. The site selected was an old coal cellar in the basement of the castle below the state apartments. The FSM probe cover and BPI pipe were located on the lawn in front of the state apartments. The pipes did not protrude above ground and when not in use were covered by a removable turf square known to the observers as the "Royal Sod". When the post was in use the pipes were extended. The GZI was inconveniently sited on the Brunswick Tower which entailed a strenuous climb for No 3 Observer who was responsible for changing the papers. The efficiency of the post was seriously compromised by the sheltered FSM and BPI instruments along with the climb up to the GZI and the post only remained in use for "sentimental" reasons.



View along the underground passage leading to the State apartments. The post entrance is on the right. C/Obs Palmer on the left and Bob Pickwood are seen entering. Photo received from Bob Pickwood



View from the Brunswick Tower next to the GZI. The post is roughly halfway across the grass leading from left to right. Photo Bob Pickwood

As the post only opened a year before the 1968 defence cuts it survived until stand-down in September 1991 as part of 2 Group in Horsham. On occasions observers manning the post would meet minor Royals who would ask what they were doing there. Following the fire at the castle on 20 November 1992 the building was completely refurbished and all evidence of the ROC was removed and the coal cellar was renovated as a secure document store. All requests to visit the site have been refused.

### West Raynham

The West Raynham post in Norfolk is a conventional underground post sited alongside the West Raynham airfield WWII battle headquarters. A second BPI & FSM pipe are to be seen close together on top of the Battle HQ mound indicating that the Battle HQ was to be used as the post. The Battle Headquarters is now flooded so water ingress could be the reason for abandoning the work that had already been completed.



The conventional post is seen to the right. The railings are a simple aircraft observation post built on top of the Battle Headquarters. The FSM pipe is seen behind the railings, another is seen next to the underground access hatch. Photo Nick Catford

### Sources:

Wikipedia, Sub Brit website, *Attack Warning Red* by Derek Wood, and former Observer Bob Pickwood





# East German Cold War Communications Bunkers

Tim Wellburn

5 December 2013: SIGINT from Germany: An Easter 2014 Barton Bunker Bash is planned!



The map room at Harnekop. Photo E. Weiss - Alexis Forum

Having missed Mike Barton's earlier Kunersdorf visit, a number of SubBritters smartly stepped forward to volunteer this time. The offer was enticing: three days working at, and then exploring, Kunersdorf, followed by three days of visits to Harnekop and Wollenberg, plus some unspecified abandoned facilities!

In the weeks that followed, a stream of procedural and intelligence briefings issued from HQ in southern Germany. Only a few decades ago, NATO would have paid dearly for this insight. This article draws directly on these briefings, with due acknowledgement of Mike's IPR.

## Military Context

Although the Soviets with the Group of Soviet Forces in Germany had the largest forces in East Germany (EGER) – aka DDR – the EGER armed forces were by no means insignificant. The EGER Ministry of Defence's peacetime location was at Strausberg, a few kilometres NE of Berlin. In the event of war, senior personnel would have relocated to Harnekop, its wartime command, control and communications (C3) bunker. While Harnekop had its own communications centre (comcen), this normally would have been used only as a receiving site, to prevent detection by direction finding (DF). The transmitter site was 10-15 km away, at Kunersdorf.

Wollenberg, lying to the north of Harnekop and Kunersdorf, was part of the BARS network (BARS, transliterated, is the Russian for "Snow Leopard"), a tropospheric network which spanned the Warsaw Pact (WP) countries with the exception of Romania. This network provided high-level communications facilities for the WP forces, eventually leading back to Moscow. When built, in the late 1980s, BARS was state-of-the-art technology.

Other parts of the EGER military machine had their own



One of the duplicate transmitter/receiver control rooms at Wollenberg. Photo Nick Catford

C3 networks and bunkers, in particular the air force and air defence service (LSK/LV), which were variously separate or combined organisations, in step with the prevailing Soviet model.

## Kunersdorf

Kunersdorf, construction project number 17/448, differed from other EGER bunkers in that, while it housed the transmitters, the actual transmitting points were distributed around it, roughly in a circle of about 10 km radius. Each with its own generator and underground antenna, these were disguised as small transformer or pump stations; Kunersdorf passed itself off as a meteorological observation station. When transmitting, Kunersdorf would have switched the outgoing signal randomly and frequently between the various transmitting points, thus making it difficult to DF the transmitter source.

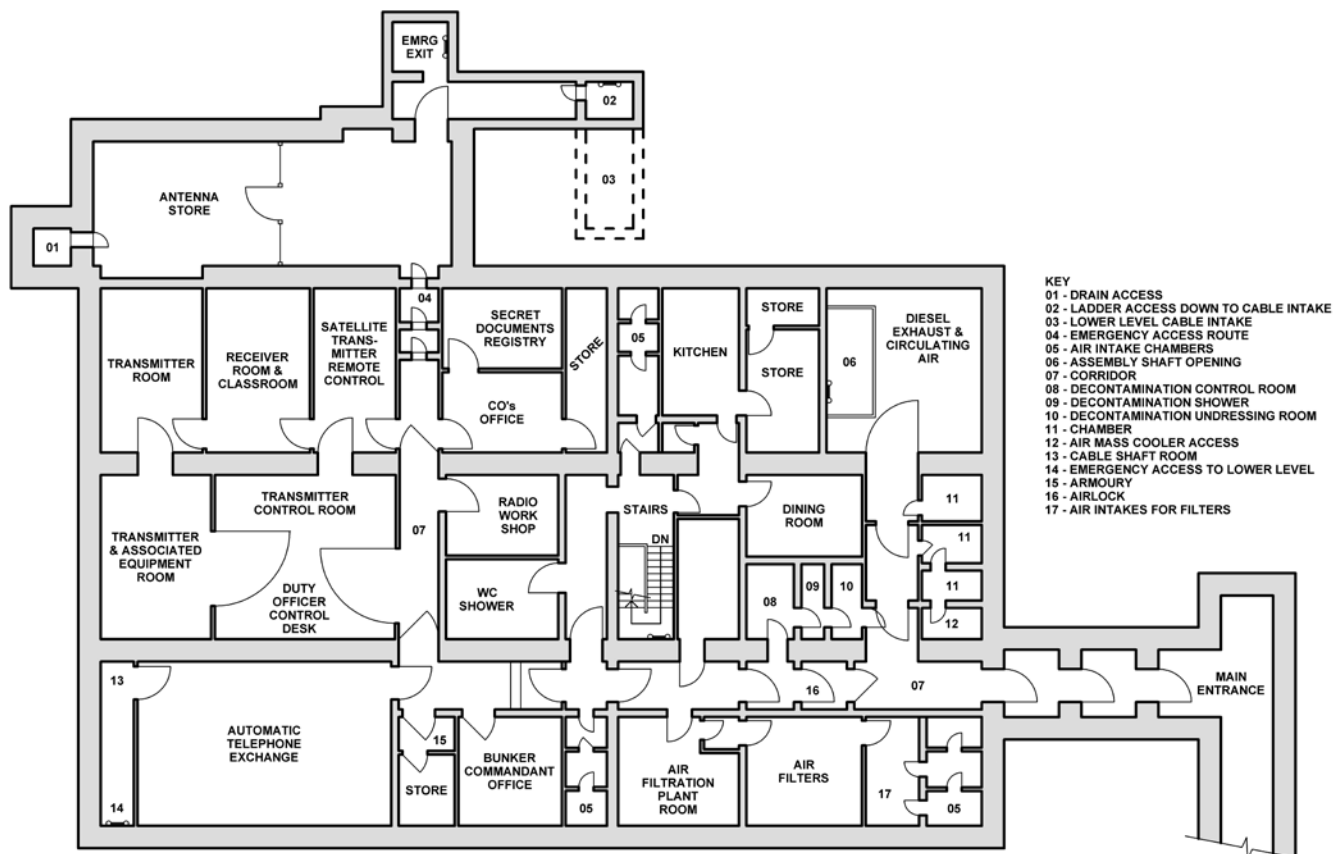
Apart from its wartime function, Kunersdorf also operated as a switching point for all communication facilities of the National People's Armed Forces (NVA) in EGER and could access and operate all major communication facilities in bunkers elsewhere in the country. When it came into service in 1981/82 it was the most advanced comcen in EGER.

## The Working Party

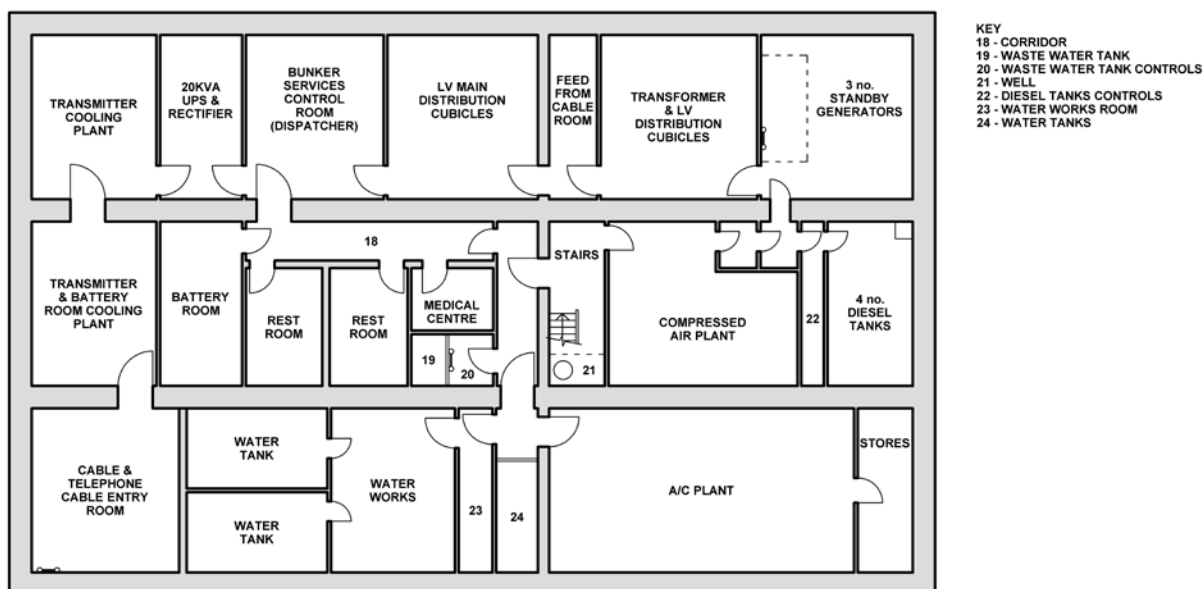
Kunersdorf is now operated as a low-key museum by its former Commanding Officer, Helmut Kirchner, who had also been involved in its original planning. It is in good condition, with a great deal of its technical equipment still in situ – and Helmut is gradually replacing missing items. However, there remains a lot of work to be done and we were there to do some of it!

Notwithstanding a cheerful initial evening at the *Zur goldenen Kartoffel* ("Golden Spud") – field HQ and billet for half the squad – we were on parade promptly





17/448 KUNERSDORF BUNKER - UPPER FLOOR PLAN



17/448 KUNERSDORF BUNKER - LOWER FLOOR PLAN

Drawn by Tim Robinson

next morning, limbering up with a bit of manhandling of kit, ranging from getting a very heavy box of electronics into position in the bowels of the bunker to retrieving an *ersatz* weather-gauge housing for display. Then we moved on to excavation and demolition: this really was “bunker bashing”! The object of these two activities was to undo the Bundeswehr’s prior efforts to seal the cable shafts, aerial tuning points and emergency exit.

We were aided by two borrowed heavy-duty power drills, only one of which we blew up. Cable entry shaft 1 was filled with broken insulators from the electric perimeter fence and proved hard graft: we never did reach the bottom, although some of the labour force acquired largely intact souvenirs (they were apparently supplied by North Korea, which no doubt still produces them for domestic consumption). Shaft 3







The working party at Kunersdorf



Opening up Cable Entry Shaft 3 required the removal of one of two original Metal Covers. Photo Clive Penfold

was thinly capped and yielded access more easily. This led, via a short dog-leg, to a circular hatch, still bearing the seal of the NVA soldier who last closed it.

Lacking the relevant key we could go no further, although the hope was that this would give access to the long-sought void under the blast cap. (Mike subsequently discovered that it did not: it led to a 10.5m-long chamber at the end of which the cables pass through the wall into the bunker.)



Excavating Insulators from Cable Entry Shaft 1. Photo Clive Penfold

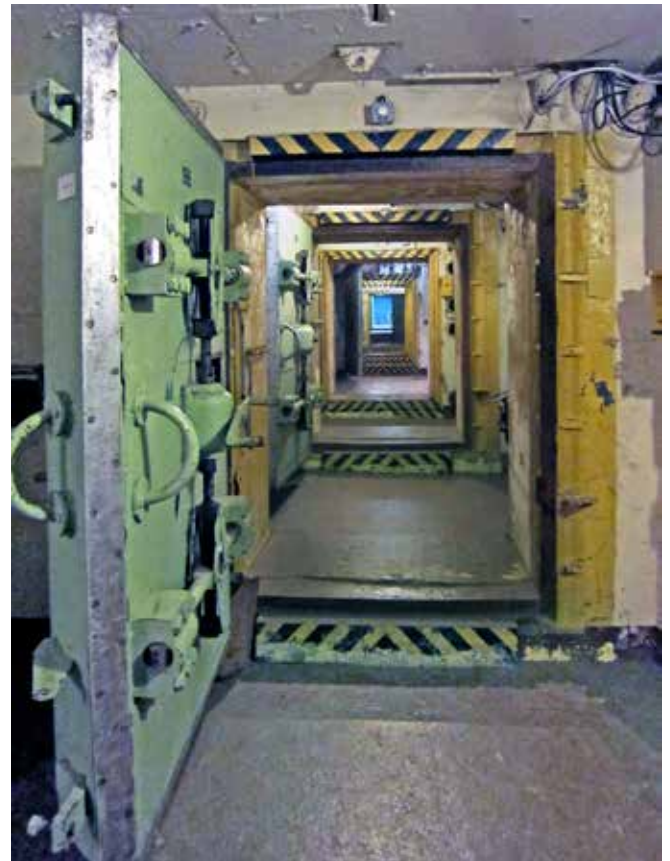
Opening up the emergency exit shaft was altogether more precarious and exciting, although after a while even Mike abandoned the technique of standing in the middle for maximum impact. The cap finally demolished, he pulled rank to make the first descent – and Helmut followed. At the bottom we found the original lead-covered timber shutters. These were lifted to surface with the equipment to hand, viz: a rope, a lot of labour and even more adrenalin.

Others dug down from the antenna tuning point along the cable course to one of the earth antennas: work that was to be completed at a later date by Helmut with the help of a mini-excavator. The more cerebral BBC-types in the group used a cable tracer to plot the course of power cables from the entrance building down to the accommodation area and the transformer building – and later went antenna-hunting.

Helmut was surprised and delighted with the amount we had achieved, and later celebrated this with us at the Golden Spud. He subsequently told Mike that our exploits at the bunker had been (mis)reported in a local newspaper: we were described as former spies and, worse, it was claimed that we had worked on a Sunday, which is not permitted!

#### **Kunersdorf explored**

We needed no prompting to be on time the next day: freed from our labours – which had actually been enormous fun – we were now at liberty to explore every nook and cranny of the bunker.



The entrance blast doors at Kunersdorf - the only EGER bunker with such a view. The decontamination suite is to the right.

Photo Tim Wellburn





Entry to the bunker is at ground-floor level from the back of a small administrative building set against a low hillside. A dog-leg access tunnel has a predetermined break-point in the walls to enable the bunker (or the tunnel) to be shifted sideways in the event of a close call from a blast wave. The bunker design was apparently empirically tested via an actual nuclear blast wave at a remote site in the USSR!

The bunker is rectangular in plan on two levels (37.5 x 23.4 x 13.5m). A blast cap, 2m thick extends 7–18m beyond the bunker outer walls. There is a gravel bed beneath the blast cap with an (as yet not accessed) air gap above it. Various sheds on the roof of the bunker conceal air intakes and exhaust pipes.

Attached to the bunker are the partly bunkered cable-entry points, on which we were working the day before, and also a large “mass air cooler” (MAC). Set in the air intake for the diesel engines, the MAC was designed to protect their operation in the event of a nuclear explosion by dissipating the air’s heat and velocity. This was achieved by drawing the air through a set of small-diameter tubes set in a 10 m-long concrete (heat sink) block and then routing it through various dog-legs and small chambers where it would gradually lose velocity. We were able to access this – with a certain amount of determination and dexterity!

Another of the bunker’s accretions is the so-called antenna store (actually more a spare-parts store), immediately adjacent to which is the emergency exit tunnel (more circular hatchways to negotiate) leading to the now uncapped exit shaft. One of the drainage sumps located around the bunker and which go down even deeper is also to be found here (and explored). On the inner side of the antenna store, i.e. in the bunker itself, were the rooms where the transmitters stood. Helmut has now managed to acquire one of these transmitters – and it works.



The Control Room: Tim Wellburn practises shutting down the bunker. Photo Clive Penfold

As will be evident from the floor plans and pictures, this is a fascinating bunker. As well as helping Helmut restore it, Mike Barton has embarked on an ambitious

project to develop a highly detailed 3-dimensional plan of the facility: the original (2-D) plans are apparently inaccurate! A visit is highly recommended.

### Wollenberg

The convoy to Wollenberg departed the Golden Spud at 09:00hrs sharp next morning – a bit of a scramble for some of those billeted some distance away in Wriezen.

The ultimate purpose of Wollenberg and the rest of the BARS network (comprising 26 stations across the WP) was to provide the communications to support a nuclear strike: either first or retaliatory. Wollenberg (BARS site 301) was constructed from 1982–88, one of three in EGER: the other two were at Bad Sülze (near Rostock) and Röhrsdorf (near Dresden). Each EGER site cost 45 million marks (approximately Euros 22.5 m). As well as the tropospheric link, these stations had cable and radio links to high-level EGER military formations.



Remains of a BARS mast and diesel exhaust outlets via ancillary buildings. Photo Clive Penfold



The entrance blast doors at Wollenberg. The door on the right goes straight into the bunker, that to the left goes through the decontamination area. Photo Nick Catford

There was no WP standard BARS station design: indeed, some were not bunkered and others used mobile facilities. Wollenberg, like its EGER sisters, is a two-storey bunker, approximately 30 x 29 m, with a blast cap



extending some 3.5 -12 m beyond the bunker. This is approached via a long dog-leg tunnel intended to shield its occupants from the radiation from the antennas. These were mounted on three tall masts which bounced the signal off the ground 2 – 5 km away, up to the troposphere 12 – 15 km above the earth’s surface, from where it was reflected towards the next station, some 160 – 180 km distant. A fourth mast with its antennas facing westwards in anticipation of the “seven-day” trip to the French coast was never completed.

Three 400 kVA standby diesels (one a reserve) met the emergency power needs. To avoid the attention of heat-seeking missiles, the exhaust generated by these engines was routed to outbuildings, where it was dissipated via ‘normal’ chimneys. Wollenberg also had some mobile units (lorries mounting large bowl-shaped antennas).

The entire site seemed unusually complete and to have been restored close to original state: for example, the electric perimeter fences were intact (one would have hesitated to touch them) and going inside was like entering an operational facility. Consoles were illuminated, sets of keys hung in glass-fronted key cabinets, closed doors carried wax seals, the clocks ticked and storerooms were impressively stocked.



Compressors for the compressed-air tanks.  
Photo Tim Wellburn



Interior of mobile BARS vehicle.  
Photo Tim Wellburn

All the electrical equipment seemed to be present, correct and switched on. Indeed, as part of the comprehensive tour, the curator, Falko Hartmann, turned off the control room lighting to demonstrate the complex of illuminated displays showing the status of the bunker’s myriad systems. In the basement, the diesel generators appeared fully serviceable: only the dials on the compressed-air cylinders showed that they awaited charging.

We were able to access the confined space and tunnel which carried the transmitter microwave waveguides and cables to one of the mast sites, up to the point where they disappeared into the thickness of the roof. We backtracked through the bunker to emerge at one of these masts. From here, we were conducted round the site to see the other mast locations and supporting surface infrastructure.

The latter notably included the bunkered garages, where we were able to examine the impressive collection of BARS and other military vehicles. We were able to board these (at least one had separate forward and reverse direction steering wheels – did the WP envisage retreat?) and marvel at the highly sophisticated, if rather claustrophobic, control rooms of the communications vehicles. There was also an extensive museum, which could probably have kitted-out all of us as NVA *Soldaten*. Our visit to this fascinating facility concluded with a welcome lunch (with bar) on site.



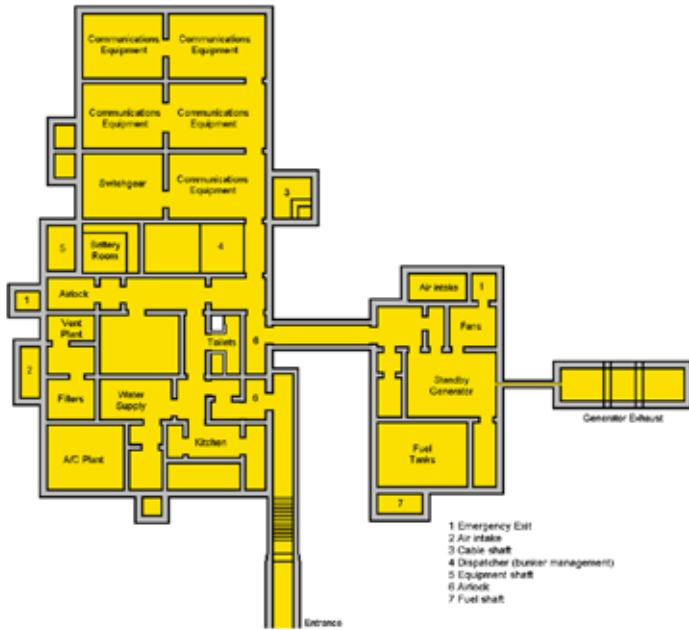
Electric perimeter fence (HSA) at Wollenberg. Photo Tim Wellburn

### Heinersdorf

Our next destination was a much earlier communications facility: part of an LSK/LV radio-relay (radrel) network built in the 1960s. Heinersdorf, the (classified) designation of which was RFBS 4, came on stream in 1965. It also served as the LSK/LV command post out in the field, so was slightly larger than others in the network.

To support the 1970s introduction of automated battle-management in higher-level command posts, the four original RFBS sites were upgraded and the radrel network was extended to ten sites set in an arc extending from Rostock to near Dresden. Heinersdorf eventually





Diagrammatic plan of the Heinersdorf bunker

became the key station in the LSK/LV radrel network, able to handle 960 voice channels. It was closed in 1996. Heinersdorf housed twenty men with a shutdown capability of 72 hours and combat capability of four days. It was assumed that, in the event of a crisis, personnel would remain in the bunker: six bunks were provided for ‘hot bedding’ but there were no facilities for decontamination or passing through the airlocks. Nor were there any compressed-air stocks or (Soviet) oxygen scrubbers to refresh the air in the event of a prolonged lockdown. Emergency power was provided by two 200 kVA gas-turbine generators with two weeks’ fuel supply. The gas turbines were initially designed for an unsatisfactory EGER aircraft: although electrically excellent, they apparently consumed large quantities of fuel!



Bunker entrance

We eventually found the bunker, obscurely located deep in a wood, through a mixture of reconnaissance, perseverance and GPS! Access steps led down from a doorway set in a raised mound, on top of which are the emergency exits, air intakes and exhaust vent. Adjacent slit trenches provided some defence from infantry attack.



Empty electrical distribution racking with Richard West on guard.  
Photo Tim Wellburn



Slit trenches for all-round defence. Photo Tim Wellburn

The bunker is single-storey, but has an interesting layout: the gas-turbine generators and their fuel tanks were located in a mini-bunker, linked to the main bunker by a corridor. Each part has its own emergency exit. In





turn, a small (but negotiable) conduit leads from the generator room to an outlying engine exhaust chamber. The bunker had been stripped of almost all fittings other than some conduits and racking – and, in one area, some residual pine wall cladding. Armed with our torches and a basic plan provided by Mike, we happily spent the rest of the afternoon exploring all this.

### Harnekop



The next day commenced with a visit to Harnekop, EGER MoD's wartime C3 facility. Operated as a museum, the tour follows a (quite restricted) set route, with a "No photos!" rule. The custodian seemed to regret that it is no longer in service. He also claimed that although NATO knew that something was there, NVA ruses meant that they never knew its role – or importance.



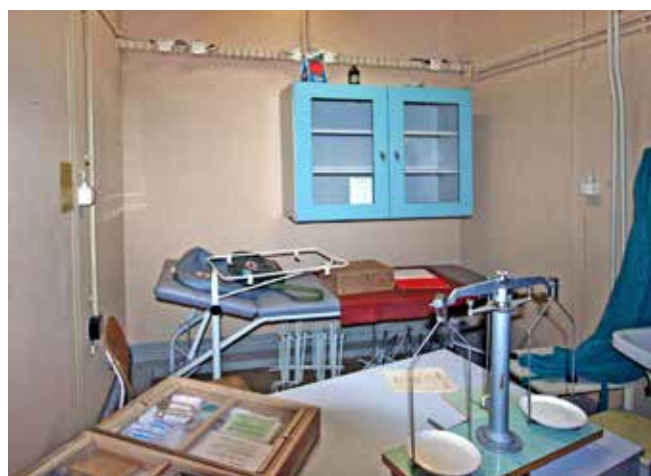
The computer room. Photo E. Weiss - Alexis Forum

As project no.16/102, construction of Harnekop was authorised in 1971 and it came into service in 1976. The final cost, including later improvements, was some 125 million marks: nearly sixty percent over the original estimate.

As the cost and function suggest, Harnekop was a substantial facility, intended to offer protection to some five hundred personnel for a period of four weeks. These included about 180 operations staff, 230

communications staff and 60 maintenance and service personnel. Ten dormitories provided hot bedding in the form of 160 triple bunk-beds, suspended from the ceiling.

Harnekop was designed to provide Class A Protection (i.e. to withstand 'bunker busters' and to remain operational in the event of a 150 kT nuclear warhead exploding 400 m from the bunker). This necessitated installation of Soviet bunker equipment. Structurally, it sits on a foundation slab 3 m thick, with 1.5 m external walls and a 1.2 m roof protected by a 4.6 m thick blast cap atop a gravel bed. The whole bunker was encased in 6 mm sheet metal to create a Faraday cage. Some of the rooms have raised floors mounted on railway carriage springs to offset the effects of any transverse blast waves. It could operate in 'shut-down' mode for 36 hours.



Sick bay. Photo E. Weiss - Alexis Forum



Canteen. Photo E. Weiss - Alexis Forum

The bunker is rectangular in plan (63 x 40 m) and contains 220 rooms arranged on three storeys. Access is by a flight of stairs from the entrance hallway of the two-storey HQ building. Each floor was functionally distinct. Level 1 provided command and control, accommodated the staff officers, and included the medical section, decontamination tract, filtration facilities, compressed-air reserve and cable entry points. Level 2 provided command and control for the individual arms and services, and contained the catering, rest rooms and (Lamson-like) tube exchange. Level 3 contained the



computers, transceivers, EPS, battery room, deep well, sewage facility – and the facilities manager.

The bunker appeared to be intact and fairly complete: the publicly accessible rooms were largely furnished, including with maps and communications equipment. The kitchen was equipped with utensils and the mess rooms with crockery and even plastic flowers. The Minister's suite is wood panelled – aesthetically an improvement on the lurid EGER wallpaper in some other rooms, but strongly criticised by Soviet construction engineers due to the risk of lethal splinters in the event of an effective blast wave. Seemingly, the Minister ate in solitary splendour, like a ship's captain, albeit with a photograph of Honecker on the wall, presumably as an aid to digestion.



Pneumatic message tube terminal. Photo E. Weiss - Alexis Forum



Bunker control room – all life support and plant is controlled from here. Photo E. Weiss - Alexis Forum

The custodian's sometime partner had kindly volunteered to come in to cook us lunch – a traditional German 'one-pot' soup dish, from memory. It was not clear whether this was prototypical EGER bunker fare.

### Müncheberg

Our second visit of the day was to Müncheberg, the LSK/LV joint command post for Fighter Squadron 8 and Radar Battalion 61. This formed part of the air defence of Harnekop, among other key facilities. Designated Objekt 16/05/239, construction started

in 1978, with hand-over in 1982. The oldest bunker of its type, it served as the prototype for the LSK/LV SAM brigades. Further similar facilities were built at Holzdorf, Ladeburg, Laage and Parchim – all of which were subsequently taken over by the Bundeswehr.



Air locks at the entrance to the bunker. Photo Tim Wellburn

The bunker is two-storey and rectangular in plan (35.4 x 29.4 x 12.6 m) constructed with a reasonably heavyweight blast cap (3.45 – 3.75 m) extending 5.7 m beyond the 60 – 70 cm outer walls. It was designed to provide a survival time of two weeks for about one hundred personnel, with a shutdown capability of between 12 to 16 hours. Unlike the Heinersdorf LSK/LV radrel bunker, it was provided with decontamination airlocks. Emergency power was supplied by two 400 kVA diesel generators. Bunkered garages were provided elsewhere on site for mobile elements.

Müncheberg presented a stark contrast to Harnekop: seemingly abandoned, with the prior permission of the landowner, we were free to explore every space into which we could find our way! Entry to the bunker is from a dilapidated single-storey brick building, down a staircase and along a long, black-painted corridor leading to the blast doors and decontamination airlocks. The core of the bunker is a full-height plotting room. This seemed a vast and rather sinister space, an impression increased by its black-painted walls. Running the length of one wall, at first-floor level, was a metal walkway; on the opposite side a suite of accommodation projected, with windows overlooking the plotting floor. We eventually located a locked door



in the passageway running behind this area, which we assumed gave access to these rooms. The plotting room had clearly been reused at some time as a nightclub. The provenance of the large line-drawings of attack helicopters and swing-wing strike aircraft etched on the walls was unknown.



Control room for life support and plant. Photo Tim Wellburn



Generators. Photo Tim Wellburn

Surrounding this central area, on two levels, were the bunker's other rooms, including the plant and machinery spaces, and connecting stairs and passages. Some of the latter were cluttered with the debris of subsequent recreational usage, but in amongst this we found broken pieces of perspex marked with tables and radrel designations, which had clearly been part of the air defence plotting system.

The control room was a surprise, with the consoles and panels in situ and largely undamaged. Those of us with an electrical bent, having earlier explored a number of electrical cabinets by torchlight, then discovered that the ceiling lighting still worked in this room, which gave pause for thought about what other circuits might still be live!

Both generators, together with related plant and equipment, were also still in place. Extraordinarily (for

those accustomed to UK vandalism), even the gauge glasses were still intact. The end of one of the generators had been part-dismantled, where somebody had either been working on it or seeking to remove bits, but the other one looked as if it would run with only minimal attention.



Kitchen. Photo Tim Wellburn

There were a number of emergency exits, egress from which was by laddered shafts, the hatches of some of which we were able to identify on the surface and open up, although further surface exploration was rather curtailed by a heavy rain shower.

We retreated, via a quick wash and smarten-up, for our last, very convivial, dinner at the Golden Spud, some of us having managed to find and inspect the terminus of an unusual narrow-gauge overhead electrified railway on the way back.

### **Government Hospital: Berlin-Buch**

Our final site, visited the following day, was the EGER Government Hospital, awaiting imminent demolition.

Built in the 1970s to treat government personnel and other 'important' people, it had a net floor area of 23,000 m<sup>2</sup> and provided three thousand beds. It was staffed with specialist doctors and surgeons, and both equipment and medicines (often procured from the West) were the best available.

A separate hospital for the exclusive use of the Stasi, located in the same grounds, provided nearly another thousand beds. Between the two, they constituted the largest hospital complex in the world. In 1990 equality briefly asserted itself when the hospital was opened to the entire DDR population. In 2001 the complex was sold and subsequently replaced in a separate part of the grounds by a modern private-sector facility.

Our convoy arrived in moderate order and we were duly admitted by the security staff (who were also engaged in blocking off illicit entry points). A vast angular grey concrete building ranging from two to seven storeys in height confronted us, clearly abandoned but displaying no evidence of vandalism. We were admitted through an obscure door and given a rapid but useful orientation tour.



The swimming pool. Photo Günther Schäfer - Alexis Forum

We saw an indoor swimming pool – favoured by Honecker and Mielke (head of the Stasi) – but I never managed to find this again, such was the relentlessly disorientating homogeneity of the interior of the



A blast door gave access to the bunkered basement.  
Photo Günther Schäfer - Alexis Forum

hospital: endless identical gloomy corridors with empty rooms on either side, and occasional stair/lift lobbies.

A blast door, down some steps from one of these nondescript corridors, gave access to the building's bunkered (or at least, semi-hardened) basement. This was also a warren, but principally housed the building's plant. This was on an heroic scale, with regimented ranks of valves and pipework receding into the gloom, beyond the effective range of our torches. Two enormous cylindrical steel tanks were installed in a (sub-basement level) pit. The generators had been removed, but everything else seemed intact.

Others went on to explore the Stasi hospital, but as this (apparently) was not bunkered, we bade farewell to Mike and the rest of the party, in order to visit Berlin's superb Technology Museum before catching our flight home. It had been a superb and rewarding trip, and we are grateful to Mike and all his contacts for arranging and facilitating it.

Helmut Kirchner, with Mike's help, is doing splendid work in restoring Kunersdorf and they deserve the full support of like-minded bunkerites: the opportunity to join one of their occasional working parties should not be missed!



The plant control room.  
Photo Günther Schäfer - Alexis Forum



# Shropshire Copper, Lead & Limestone: Clive, Snailbeach & Pitchcroft Mines

Tim Wellburn



The white spoil tips on the northern edge of Snailbeach village were a well known local landmark until Shropshire County Council landscaped the tips and planted trees as part of the mining reclamation works which started in February 1993. This view is from summer 1991. The chimney in the foreground is for the 1881 compressor house while that on the hill is the Snailbeach smelter chimney with the flue running from the smelter which is much lower down in the valley. The white cottage behind the 1881 chimney is the former count house; the other house is modern. Photo Peter Eggleston, I.A.Recordings

In conversation in Prague one evening during SubBrit's April 2014 Study Tour, a group of us asked Mike Moore if he might organise a visit to Snailbeach lead mine? He readily agreed, and subsequently did us proud, delivering a fascinating 'long-weekend' itinerary exploring Shropshire's industrial archaeology. The trip culminated in an invitation to dinner at his home, where we enjoyed an exceptional curry which he had prepared himself. This really was a visit to remember.

As well as visiting Snailbeach, Mike had managed to include us on an evening trip down Clive Copper Mine,



The Sub Brit group in Clive mine. They are Richard West, Clive Penfold, Tim Wellburn and Nigel Ostler-Harris

organised by Shropshire Caving and Mining Club (SCMC). This was something of a privilege. There is a submersible pump in the mine which provides the local water supply and the landowner requires strict control of access: temporary SCMC membership and BCA insurance are both needed. The mine has similarities to those at Alderley Edge, visited by SubBrit in September 2011.

### A bit of history

The documented origin of Clive mine is in seventeenth-century "open cuts". As these ceased to be viable, a series of small neatly-cut square shafts was sunk in the sandstone to access the copper vein. These mines are likely to have been unconnected enterprises: the present linear mine is thought to have come into being only when the original shafts and tunnels were undercut by later eighteenth-century workings.

In turn, the Victorians reworked the mine, digging out large stopes, which largely obliterated the earlier workings. A tramming level exists (or existed) below the Upper Level, with a Lower Level some eighty feet (24.5m) below, connected by winzes. The lack of mineralisation in the Lower Level suggests a (later) tramming function.

Two access shafts to the mine remain: the 'Well Shaft' (the deep sump of which contains the water supply pump) and the 'Rubbish Shaft' which SCMC dug out in order to obtain easier access to the Upper Level. A shaft in the





southern section of the mine, adjacent to a road junction, was the centre of an extensive collapse. The other, early shafts have been capped. Notwithstanding considerable investment from the early 1860s, it is reported that the mine “did no good” and mining had ceased by the end of that decade.

### **Rubbish!**

Access to the Upper Level of the mine is now via the 25 foot (7.5m) Rubbish Shaft. This lies just to the other side of a lane wall, no doubt facilitating prior disposal of the eponymous rubbish. However, we approached it in slightly circular but distinct style via a foot tunnel under the lane: part of the ‘Ladies Walk’ which enabled the ladies of the estate to reach the church without needing to cross roads!



Wall Traverse above the Main Winze. Photo Clive Penfold

We descended the shaft using a fixed ladder and lifeline, and headed north. This quickly brought us to a large stope, in the bottom of which is Main Winze. Not wishing to risk an unintended visit to Lower Level, we roped up for a wall traverse, using harness and cow-tails kindly loaned by Mike and patiently assisted by members of SCMC. This undoubtedly looked (and at times felt) more dramatic than it really was, and certainly added a certain frisson to the proceedings!

As we followed the level through a number of tall stopes, we could clearly see copper staining and the truncated bottoms of the old hand-picked shafts, all offset to the centreline of the present mine. In places, the floor had been dug, or collapsed into the tramming level immediately below. In due course, we reached the

major collapse, now marked by a concrete wall with a small access tunnel set in it, which angled upwards quite steeply. This then turned into a horizontal crawl which led to an equally steep downward slope, giving access to the northern section of the mine.

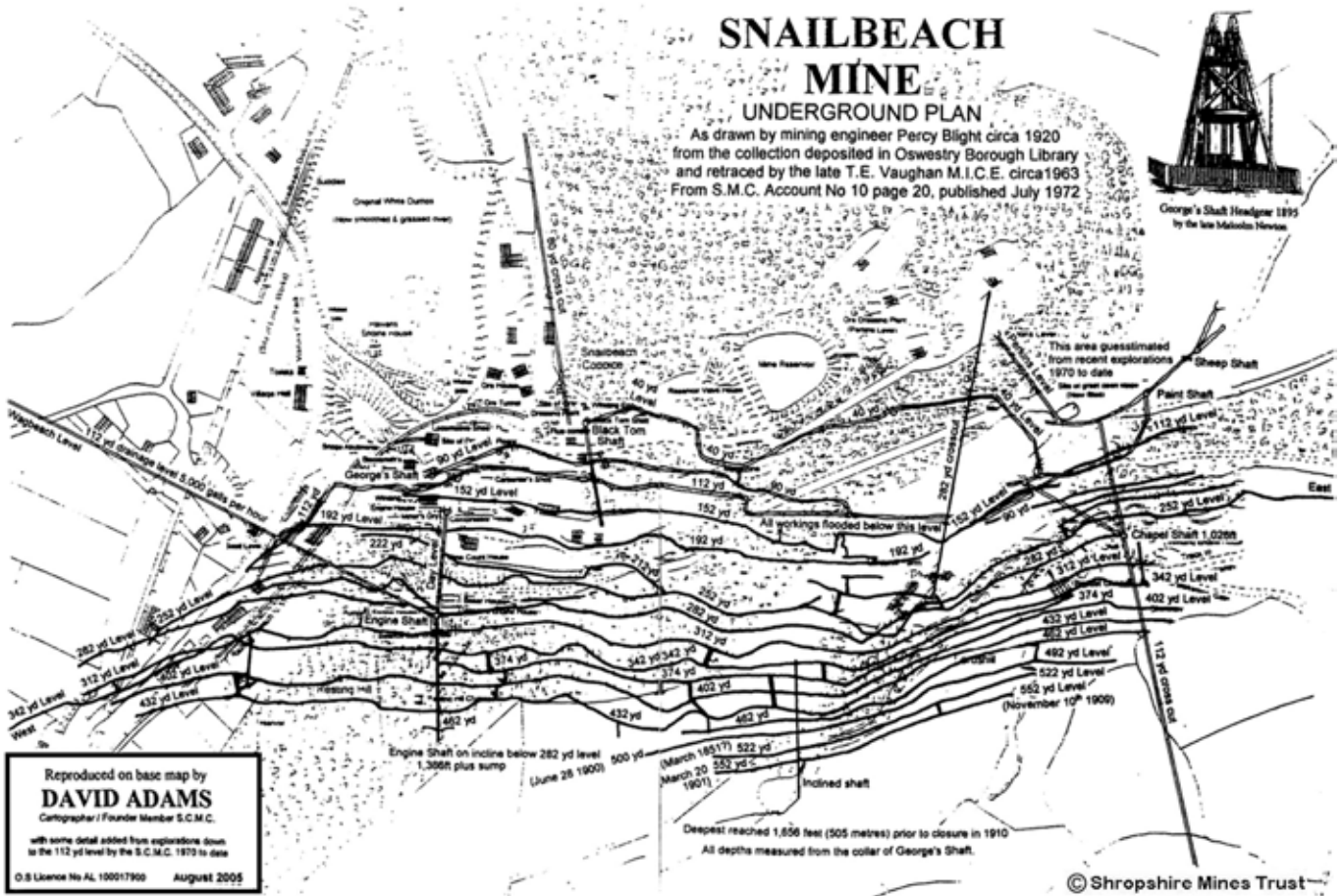
Mike later showed us a video of SCMC members making their way over the top of this collapse, before the concrete reinforcement was installed, which explained the access tunnel’s ‘up, along and down’ profile. The ore vein must have run out shortly beyond here and a number of trial levels showed where the miners had unsuccessfully sought for it. Indeed, the mine ends only just beyond the Northern Winze with two blind headings, one driven below the other. This part of the mine has some very attractive patterns of finely banded rust-staining in the rock, having the appearance of sections of tree-rings set in a random montage.



Rust staining. Photo Clive Penfold

We returned whence we had come, over the collapse and across the traverse, right foot first and more downhill this time. Passing Rubbish Shaft, we carried on to the South Winze. This section of the mine was previously unstable, and has been reinforced with a concrete retaining structure by SCMC – at some considerable physical effort, as all materials had to be brought in by bucket load. A trial heading, ending in small conical roof-fall chamber, marks the southern limit of the Upper Level. We returned to Rubbish Shaft, emerged into the night and retreated, together with a good number of SCMC members, to The Railway Inn at Yorton, a friendly and unmodernised little pub.





**On to Roman Snailbeach**

The following morning, after a fine ‘Full English’ breakfast at the Swan Inn – the very decent pub in Newport which Mike had recommended to us – we set out for Snailbeach. En route, Mike took us via Pontesford to see two old residential adaptations of a colliery engine house. He knew the owners of the second of these

sufficiently well for us to invade their garden to inspect both of its aspects – a real piece of living industrial archaeology.

Snailbeach probably has the best preserved mine buildings in the country and is well documented, thanks to the efforts of the Shropshire Mines Trust and others. It was the biggest lead mine in Shropshire and, per acre,



Snailbeach mine in 1949. Although most of the buildings appear derelict the mine was still in operation at this time. A Baldwin locomotive is seen outside the shed. Photo Jim Pedon

is said to have been the highest yielding in Europe. An ingot from Hadrian’s time found there confirms its Roman provenance but, after their abandonment of it, it may not have been worked again until the mid-sixteenth century: systematic working is documented only from the second half of the eighteenth century.

Unusually, all depths at Snailbeach are recorded in yards, from the collar of George’s Shaft. A 1200-yard-long drainage adit, cut from the Hope Valley, intersects the 112-yard level. Below that, water was pumped up to the adit, initially by a waterwheel, but from 1793 by a Boulton & Watt steam engine. The most productive period was in the mid-nineteenth century – by when the 300 yards level had been

reached – with an annual output of some 3000 tons of ore and 2700 tons of lead. The mine eventually reached the 552-yard (276 fathoms; 505 metres) level in 1900, but the slump in lead prices in the early twentieth century sounded its death-knell. Pumping ceased in 1919 after which the mine flooded to adit level. Underground working ceased in 1955, although the tips were reworked until the 1970s.

We bumped across an overgrown railway track, part of the Snailbeach District Railway (SDR) built in 1877 to connect the mine with Minsterley, and parked next to the fine twin-road Locomotive Shed. Sadly, this no longer houses locomotives (the last was scrapped in 1950) but it did contain a reconstructed SDR hopper wagon – and also an old tractor, looking for an enthusiast...



The compressor boiler house. Photo Tim Wellburn



George's shaft. Photo Clive Penfold

We followed the track – an unusual 2' 4" (0.71m) gauge – north past the Ore House to the ore processing area where a rebuilt Harz jig and spiral washer is on display. Just beyond this is Black Tom Shaft, which dates from the early nineteenth century and was worked for barite and galena until 1928. It has now been capped but the headgear has been reconstructed and the small wooden Winding Engine Shed sympathetically restored.

We returned to the Locomotive Shed and climbed up to the very fine cluster of buildings around George's Shaft – which also features reconstructed headgear. Opposite this is the 1790 Engine House, the oldest building on the site, and adjacent to it is a blacksmith's shop, a real time-capsule, which contains two forges, one of which is still operational, and a wonderful assortment of old tools. The adjacent 1872 Engine House once contained a horizontal steam winder, and another steam engine would have been found in the substantial 1881 Compressor House, next to which are the interesting remains of its Boiler House – complete with flues and a largely intact chimney. Other buildings in this group include the Mine Office, the remains of a Crusher House and Carpenter's Shop and the Miners' Dry, now the mine's Visitor Centre. This we would see later, together with Day Level.

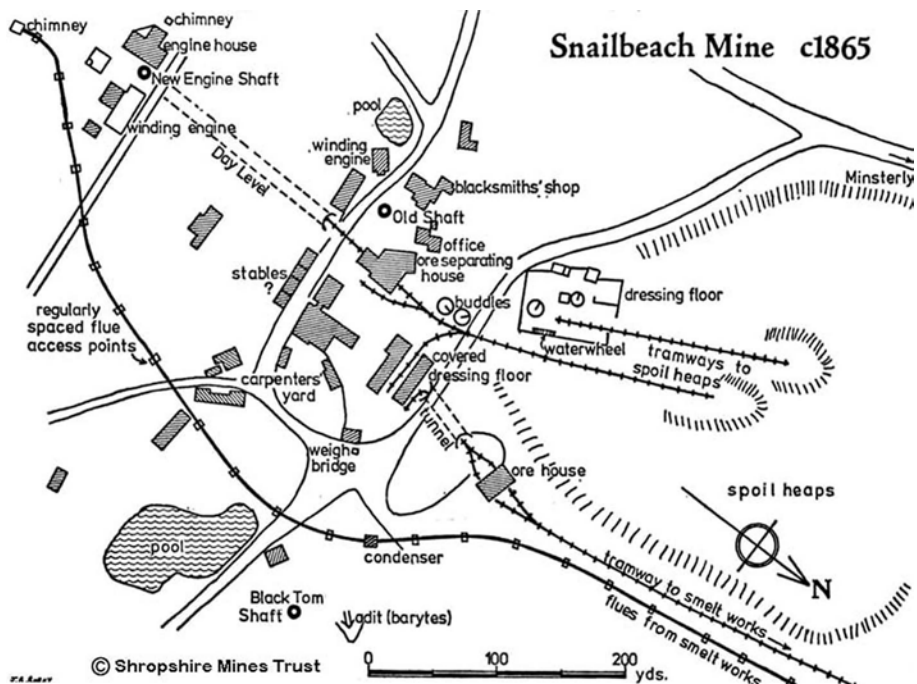
Our underground exploration started with Robert's Level. En route we passed the very substantial Explosives Magazine. This closely resembled a military magazine, built with stout inner and outer walls, which gives some indication of the size of the mine and level of activity at its peak. Robert's Level, which worked lead and barites, is an upper working and so remains drained. A long straight roughly-cut tunnel eventually reaches a junction. We explored both branches in turn.

One led to a large stope: the first evidence of any return for the miners' labour. The level continued beyond this for some considerable way, with a number of headings off, some of which were blind and others sealed, but eventually reached a dead end itself, the miners having given up their quest for the lode in that direction.



The entrance adit of Robert's level. Note the stacked rail on the left; this has been stripped out of the mine for salvage but was never taken. Photo Tim Wellburn



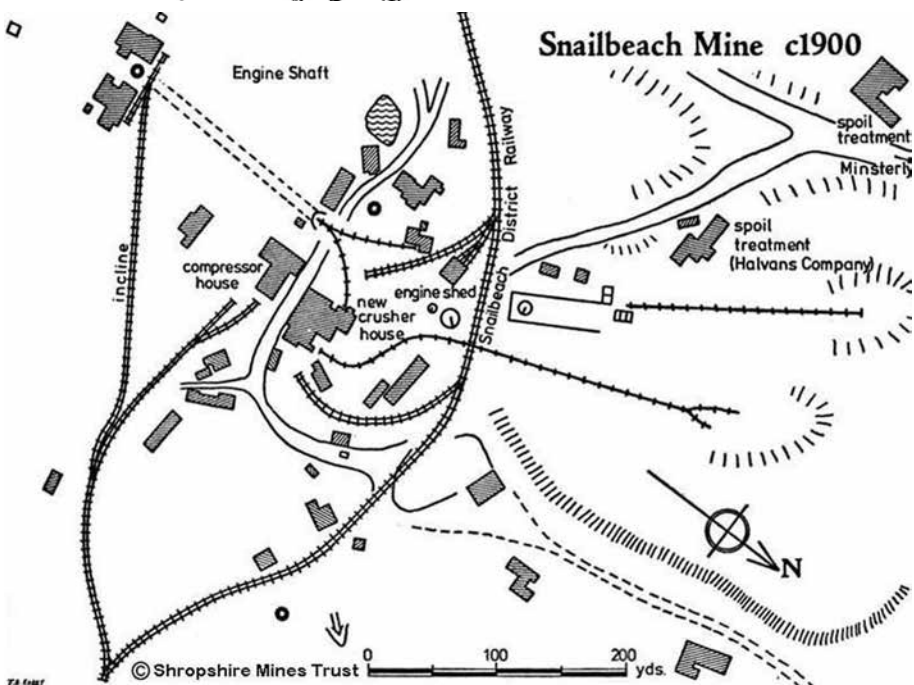


boilers) we came to the mine's main shaft, the 1300-foot (396m) Lordshill Engine Shaft. This was used both for winding and pumping. However, it is the massive 1858 Pumping Engine House that immediately catches the eye.

This once held a 60-inch Cornish beam engine that worked until pumping ceased in 1911. On the opposite side of the shaft are the remains of the Winding Engine House, once home to a horizontal steam winder, and next to it the Boiler House. The entrances to the flue are still intact at the far end of this otherwise rather dilapidated building. A further short climb brought us to Resting Hill Chimney, which is also connected by another flue to the more distant Smelting Works.

The other branch took us into a small stope where the Shropshire Mines Trust had constructed a bridge to provide safe passage for visitors. Beyond this was a very large stope, half filled with a cascade of rock waste and/or roof fall. The scale of this cavern was (literally) highlighted by a distant illuminated mannikin placed near the top by the Trust. Several of us felt obliged to ascend this rock cascade – but not the long ladder at its head that led onward and upward...

Back in the daylight, we inspected a collection of kibbles in a dressing shed and then continued up the hillside. Just beyond the head of the coal incline (which supplied the



Nigel Ostler-Harris standing at the junction in Robert's level, notice the steel Armtec tunnels to the right which was an open stope to the surface and was previously the only access into the lower workings. The tunnel ahead had previously been filled with rubbish from stope above. Photo Clive Penfold

Lordshill Shaft was intercepted in 1848 by the driving of Day Level, in order to bring the ore out of the shaft directly to the Crusher House, one of the buildings adjacent to George's Shaft. Day Level runs for a relatively short distance in a straight line, and boasts a restored tramway complete with manrider. This proved irresistible. Arriving in style at the end of the level, we unlocked a gate which admitted us to the Lordshill Shaft chamber.

The top of this shaft, where we had stood only a little while earlier, was clearly visible, but our torches had no hope of reaching the rubble blockage at the 112-yard level some 400 feet below us. We ended our visit at the interesting Visitor Centre where we watched an informative video on the mine and examined the collection of artefacts.





1858 pumping engine house above Lordshill shaft.  
Photo Tim Wellburn

### Tankerville Mine

From Snailbeach, we visited The Bog, a large former mining settlement, now all but disappeared. Lead, silver, zinc and barytes were worked, variously, from the early eighteenth century until 1932. Two tangible mining



The Bog mining settlement

remains are the small explosives magazine and the ‘Somme Tunnel’. The latter runs on a constant heading for 135 yards, without any evidence of mineralisation. It was apparently dug in or about 1917, to provide employment to miners – mining being a reserved occupation. The former village school has also survived, happily as a superb Visitor Centre, where Mike very kindly insisted on treating us all to tea and cake.

Just north of The Bog is Tankerville Mine, which is owned by the Shropshire Mines Trust. This was worked intensively from about 1860, principally producing lead, but also other minerals as at Bog Mine. In the 1870s a local press report stated that “the rich and profitable mine of Tankerville is second in importance only to Snailbeach”. However, rising costs and falling lead prices inexorably reduced profitability and in May 1884, although the mine was far from worked out, money had

run out, pumping stopped and the company was put in liquidation. The upper levels saw small-scale working for another decade, and the tips were reworked until about 1925.



Watson's Shaft engine house at Tankerville Mine.  
Photo from Shropshire Mines Trust

Considerable conservation work has been carried out at Tankerville, in particular on the Ore Bins, Shaft Chimney and the splendid Watson's Engine House. The latter was built to house a new 40-inch Cornish engine by Harvey's of Hayle, installed in 1876 (which finally resolved the mine's drainage problems). At the time we were there, access to the Tankerville site was temporarily suspended while the lower retaining walls were being repaired. We admired its structures from an appropriate distance and then moved on to conduct close-quarters inspections of the engine houses at Ladywell and East Grit.

The latter is particularly interesting to aficionados as it had the double duty of winding and pumping, and consequently is of an unusual design. Curiously, the very overgrown engine house at East Grit appeared to share many of these features. The nearby Stiperstones Inn, clearly favoured by the SCMC and SMT, provided an excellent supper to round off a superb day.

### Above-ground interest

The following day was largely devoted to exploring surface, as distinct from underground, industrial archaeology. Most of it we would have struggled to find without Mike's guidance. Our first visit was to Pitchcroft Limestone Mine at Church Aston, a little southwest of Newport.

Curiosity about three bolts sticking out of the ground had led the SCMC to embark on a dig. This uncovered the foundations of two engine houses, the conical capping to one of the shafts, the probable base of a chimney and a number of intriguing brick conduits, which may have been flues, drainage channels or even ventilation drifts. Sadly, no records appear to survive to shed more light on this extraordinary find.

From here, we visited the extensive Lilleshall limestone quarries where there are restored kilns and tramway tunnels passing under the high embankments which separate the quarries. The adjacent Pitchcroft branch





of the Duke of Sutherland's canal boasted a tub-boat inclined plane which, together with its associated basins, is still clearly discernible. This incline replaced an earlier vertical lift in a shaft-and-tunnel system. The mouth of the old tunnel, located to one side of the incline, remains extant, still disgorging water.

Mike had been markedly taciturn about why he had included a folly on our itinerary, and we were somewhat perplexed to be led though a gap in a hedge into a wood, to be confronted with what looked like a large badger hole in the bank of a small, much overgrown sandstone quarry. Inside was one of the most extraordinary follies any of us had ever encountered: a curious underground room in the form of a spiral passage, the interior 'walls' of which had been pierced and carved into columns, with various recesses, including a small room with a stone seat. This was Caynton Temple. It really defies description, unless one's imagination can conjure up the stone-carved interior of the shell of some fantastic Romanesque sea creature?

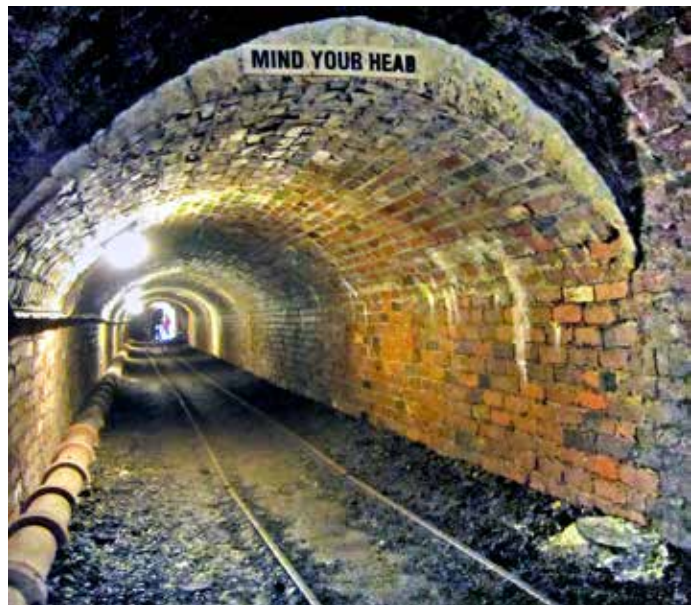


Caynton Temple. Photo Nick Catford

### Ironbridge World Heritage Site

Back to reality, we headed to Ironbridge. This, the first iron road-bridge in the world, built between 1777 and 1780 to the (second set of) plans by the architect Thomas Pritchard, needs no description, beyond saying that it is an object of singular beauty in which form follows function. We did not have time to visit any of the Ironbridge Gorge museums, other than making a final short underground trip along the Tar Tunnel. Intended as a canal access tunnel to the Blists Hill mines, when the miners struck a bitumen spring this unexpected commodity was exploited instead. The adjacent Hay Inclined Plane – also a tub-boat incline – was built in its place. This was restored some years ago, but subsequent ground movement has already buckled its rails.

We concluded the day with two superb Shrewsbury



The Tar Tunnel at Ironbridge Gorge. Photo Tim Wellburn

Canal relics: Wappenshall Canal Junction with its fine roving bridge and transshipment warehouses, and the Longdon upon Tern Aqueduct.

The Shrewsbury Canal opened in 1797 as a tub-boat canal and linked Shrewsbury to Trench, where an inclined plane gave access to the tub-boat canals serving the east Shropshire coal mines and ironworks. However, it was not linked to the national canal network until 1835 when the Birmingham and Liverpool Junction Canal opened the Newport Branch from Norbury Junction, joining the Shrewsbury Canal at Wappenshall.

While the route from Wappenshall to Shrewsbury was widened to accommodate the, by then standard, 7-foot narrowboats, the 'Trench Branch' was not: hence the need to transfer cargoes between tub-boats and narrowboats. Oddly, it was the Duke of Sutherland, rather than the canal company, who engaged James Trubshaw to design and build the transshipment warehouses. The later of the two straddles its own basin linking the canals and is equipped with overhead

trapdoors and hoists for cargo handling between the boats and its two upper storeys.

The Longdon upon Tern Aqueduct, built by Thomas Telford in 1797, was the first cast-iron canal aqueduct in the world and the precursor to Pontcysyllte Aqueduct. Currently, it stands high and dry in the middle of a field, but it is hoped may be returned to service one day. It is, quite rightly, both Grade 1 Listed and a Scheduled Ancient Monument. We had ended Mike's tour on a cultural high; the gastronomic finish still awaited us!

The group – Geraldine Delaney (from Saturday), Nigel Ostler-Harris, Clive Penfold, Tim Wellburn, Richard West and Steve Underwood – wish to thank Mike Moore for organising, leading and hosting a superb visit, and the Shropshire Caving and Mining Club for giving us access to Clive Copper Mine.



# Visiting the Harz region of Germany

David Gordon



Rammelsberg Mine. Photo Paula Soler-Moya

Germans are very proud of their mining heritage, and most of the former mining areas, such as the Harz and the Siegen area have a comprehensive collection of mining trails, surface remains, underground trips and even mineral themed beers. A quick Google search throws up more than 125 museums and show mines (Schaubergwerke, Besucherbergwerke) spread throughout the country, and of course there are famous show mines in neighbouring states such as Austria, Poland and Switzerland.

It is worth taking the trouble to do some research before visiting any of these areas, as the experience is usually tourist-orientated and can be substantially different from what an English enthusiast might expect. Tours are almost exclusively in German (and contrary to popular belief they don't "all speak English"), so get as much background knowledge as you can before you go. Signs and museum displays are often, but not always, bilingual, and leaflets for the bigger sites are usually available in English. Websites may have English pages, but if not Google Translate does a reasonable job, although it may stumble on technical terms. Although some tours will take you deep into the mine, as in the salt mines of the south, public tours often don't go beyond the

first few hundred yards of the adit. On the plus side, there are some fantastic things to see, and the German attitude to health and safety is relaxed, especially in the less commercialised concerns, with most mines having a compressed-air feed and machinery demonstrations (ride a conveyor, handle a rock drill, jump back as the train shoots past). Tours for groups are usually available and often more adventurous, but almost always involve an underground meal with plenty of beer and schnapps.



The mining complex at Rammelsberg. Photo Juemro



Underground weddings are also widely available. There's a lot of equipment on display, as well as the history of the miners' associations, which tend to involve uniforms, ceremonies and brass bands.

The Harz is the best known of the German mining districts, owing to the richness and variety of the metal mines and the unbroken mining tradition going back to the middle ages. Twenty-four museums and show mines can be found in the small area centred on Goslar and Wernigerode, while the area's popularity as a tourist destination means that accommodation is readily available, from youth hostels to luxury spa hotels. Underground tour times are usually well advertised, so it's possible if you have a car to do up to four mine visits a day. Surface remains are extensive, with interesting relics of the East German industry and one special – the last working man engine (Fahrkunst) in the world at Grube Samson in Sankt Andreasberg, which is run on open days and apparently still used to access an underground hydro plant. There are also natural caves, and an extra dimension is added by the area's recent cold war history, with major Russian and East German listening posts on top of the highest point, the Brocken mountain.

### Rammelsberg mining complex

I recently spent two days in Wernigerode, having been roped in to give my wife a lift, and ended up visiting the area's main attraction, the Rammelsberg World Heritage Site in Goslar, as well as one of the smaller mines in the former East Germany. The Rammelsberg site is the size of a small town, and popular enough to have a regular bus service from the centre of Goslar.

The tourist round includes a couple of underground trips. The surface remains include a special exhibition space and a mineral collection in the ore dressing plant, an extensive museum of the history of the plant, with many captions in English (and, interestingly, a room devoted to the memories of the wartime forced-labour workforce), an art gallery in the former power plant and a restored funicular. Tours available include the ore-dressing plant, a walking tour of town and surface remains, and a ride on the



The entrance steps into the show mine were originally where the aerial ropeway entered the mine. Photo Jochen Duceck



Machinery for loading ore directly onto the aerial ropeway at the bottom of the entrance incline. Photo Jochen Duceck



The Eimco loader is in full working order and is demonstrated during the tour. Photo Jochen Duceck

funicular. Underground tours include a train trip (takes you about 200m into the adit in closed trucks), and the Roeder Gallery tour following the course of water power from the dam via various water-wheels, both unidirectional for pumping (Kunstrad) and reversible for winding (Kehrrad – I had not come across these before). Some of the wheels are working replicas and some nineteenth-century originals. A 4-hour tour of the thirteenth-century Rathstiefste Gallery, believed to be Europe's oldest extant drainage sough, must be booked in advance. All tours can be available in English if booked beforehand. I took the waterwheel tour and despite a slow start (lots of basic information with the guide concentrating on the children) it was a very interesting hour and a half. You could spend a day, and possibly longer, here.

### Büchenberg iron mine

In the afternoon I decided to look at one of the small mines in the former GDR and went out to the very different setup at Büchenberg iron mine ([www.schaubergwerk-elbingerode.de](http://www.schaubergwerk-elbingerode.de)). Although accessible by bus, you would have to walk up the long approach drive to the car park and then down the hill to the mine entrance – about a kilometre. Coming by car you park at an abandoned industrial complex then walk down the

hill past an exhibition of mining machinery – most of it distinctly DIY – culminating in a massive core drilling machine mounted on an ex-military URAL 375 truck. The entrance is a café with a wall display giving the history of the mine – all in German but with plenty of pictures. The young chap in charge spoke some English and I was glad I had a long chat to him, as the underground guide spoke very rapidly in a local accent I almost completely failed to understand! The mine had pretty poor iron ore and was only kept open because of the dire need for materials in the then GDR. Its most interesting feature was the overhead cableway, the longest in Europe, which was actually loaded at the inner end of the steeply sloping entrance incline. The guide explained that the weather in winter is so severe that everything on the surface would freeze up, so bringing the cableway down into the constant temperature of the mine was the only way to ensure round the year working. Although the cableway has been dismantled, the loading station in the mine has been retained with a short length of cable, and the mechanism is switched on as part of the tour. Another cable experience is available for wheelchair users – they



The first train of the day departs from the station at Schierke and commences the long final climb to the summit of the Brocken.  
Photo Tarboat

can be loaded into an open-sided carriage and winched down the entrance incline! The tour does not go much beyond the loading chutes, where the cable cars were detached, pushed round and loaded by hand from a series of chutes, then pushed back and re-attached. However there is as usual a compressed-air feed which allows a demonstration of rock drill (“would you like to take the dogs back a bit in case the noise frightens them?”) and an EIMCO overhead loader (“our latest piece of equipment – very expensive”). There is also an impressively colourful section through the ore body. It would be possible to see several small mines like this in a day.

### **Brockenbahn steam railway and a Stasi listening post**

On my second day I decided to follow another of my interests (and perhaps a good alternative for family members less interested in mines). Given the proximity of the border there are doubtless bunkers, but I can't claim any knowledge of these. However one remarkable



FM-radio and television broadcasting make major use of the Brocken. The old TV tower (left), the Sender Brocken, is now used as hotel and restaurant.

It also has an observation deck, open to all tourists. The former Stasi listening post, now a visitor centre, is on the right.  
Photo Absinthias

cold war leftover is the Brockenbahn steam railway. This narrow-gauge line runs from Wernigerode and several other locations to the top of the Brocken mountain, and owes its continuing existence to the needs of the military base on top of the mountain. The Brocken, the highest mountain of the Harz at 3,743 ft, is part of the Harz National Park. The Brocken Railway is one of three tourist metre-gauge railways which together with the Harz Railway and Selke Valley Railway form the Harz Narrow Gauge Railways railway network.

Although the huts of the Russian base have been removed, the listening post of the East German secret police (Stasi) remains. Converted into a visitor centre with exhibition, it has some cold war displays and retains some of the radio equipment in the dome. The station was used to listen in to Western communications, but its main function was to communicate with Stasi spies in West Germany and beyond. There is a hotel and café at the summit, and another small café in the visitor centre itself. Again, the health and safety aspect is fairly relaxed – the coaches on the trains have open platforms at each end where the photographers cluster – especially on the down trip, when the loco isn't chucking out so many smuts. There is a simple steel bar to stop you falling off, and a notice telling you not to ride on the plate between the coaches. The mountain has long been associated with witches (in Goethe's *Faust* the hero is taken to an orgy on the mountain to distract him from his lover) and there are plenty of opportunities to buy witch-related tat, but naked orgies are frowned upon nowadays. If it's foggy (it often is) you might see the famous Brocken Spectre (a natural phenomenon).

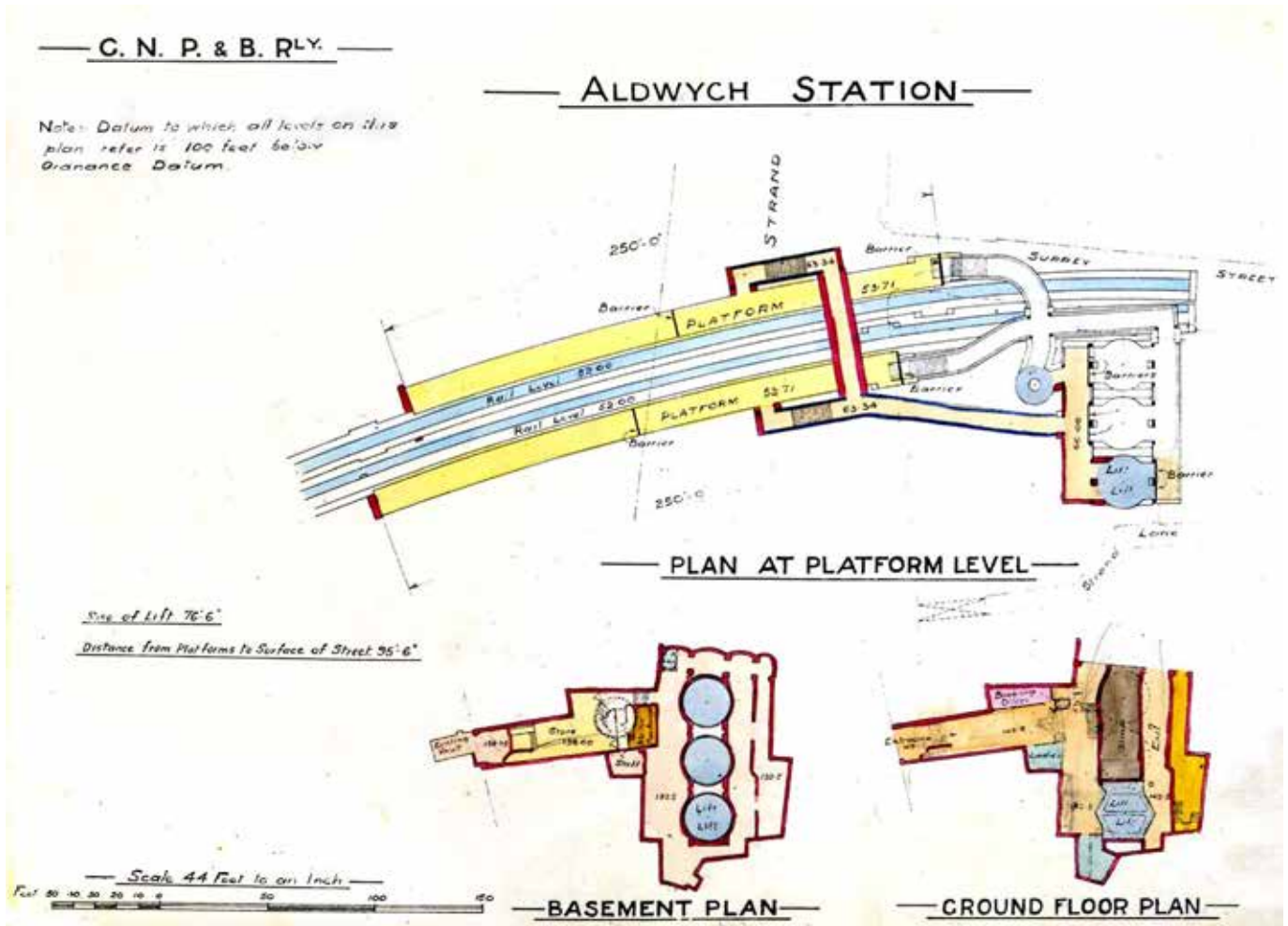
To sum up, there is plenty for the mine enthusiast, both above and below ground, Europe's longest narrow-gauge steam railway system, and the likelihood of plenty of cold war remnants. You could easily spend a week there. See also *Subterranea* 29 (April 2012), pages 46 – 53.





# Sub Brit Aldwych Station Visit, May 2014

Tim Wellburn



Richard West relates the history of Aldwych in the booking hall at the start of the tour. Photo James Buller

The last passenger train left Platform 2 at Strand underground station on the Great Northern, Piccadilly & Brompton Railway (GNP&BR) in 1914. A century later, however, the 4-car set of 1970s Northern line stock stabled at adjacent Platform 1 showed no sign of any imminent departure on the night forty SubBritters descended upon the same station (\* renamed Aldwych since 1915) on a special SubBrit exclusive tour arranged and led by Richard West.

## A short history of an extended commercial failure

Strand/Aldwych station, originally the southern terminus of the Great Northern & Strand Railway (GN&SR), was always something of an anomaly. Opened on 3 November 1907, it was an afterthought even in conception. Initially, the line was to terminate at Holborn, but the creation of Kingsway and Aldwych by a bold London County Council slum clearance scheme



Leslie Green's distinctive frontage in September 1994, a few weeks before closure. Photo Nick Catford



persuaded the promoters to carry on another 573 yards (524m) to Strand to try to tap additional traffic from the area's new offices and theatres.

However, Charles Tyson Yerkes' 1906 creation of the GNP&BR, linking the GN&SR and the Brompton & Piccadilly Railway at Holborn, left Strand station as a rather over-specified and under-utilised appendix to the new through route between Finsbury Park and Hammersmith.

Behind its two iconic Leslie Green dark red brick and terracotta glazed frontages (on Strand and Surrey Street), Strand station was provided with no fewer than three lift shafts – enough to accommodate six lifts. However, even before the station opened, it was clear that this was far more capacity than was required and lifts were only ever installed in the westernmost shaft. A second landing, behind the lift shafts, and a related set of passageways were also left unfinished and unused.

The two platforms, exceptionally short at 250 feet (76.2m), also proved to be an over-provision and they were both partitioned, with only the first 100 feet (30.5m) of each tiled and used. Furthermore, although the Holborn to Strand line was built as twin tunnels, the service was normally operated by a single two-car shuttle using only the western tunnel. This enabled Platform 2 (the eastern platform) to be closed and converted into an emergency store for National Gallery artworks after German bombing raids on London began following the outbreak of the Great War in 1914.

The eastern running tunnel was taken out of use in August 1917 and the tunnel end bricked up. In the Second World War, both the disused platform and tunnel were assigned to the Public Records Office, the Victoria & Albert Museum and the British Museum for

safe storage of large artefacts – famously including the Elgin Marbles, which remained here safely until 1948.

Wartime (both WWI and WWII) also saw the greatest footfall experienced at Aldwych, but of people sheltering from bombing raids, rather than passengers. Indeed, low passenger usage led to Sunday closure from April 1917 – the first station to suffer this ignominy. Although seven-day service recommenced postwar, by 1922 patronage was deemed insufficient to warrant maintaining the booking office and, instead, tickets were issued and collected by the lift staff from small booths built into the lifts. The traces of these booths are still discernible on the lift floors.

During the Second World War, passenger service on the Aldwych branch was suspended from September 1940 and the rest of the station and the western rail tunnel were converted into a public shelter. This involved covering the suicide pit and installing three-tier bunks, accommodating 1,500 sleepers. A canteen and lavatories were housed in the overrun tunnel. Train services were not restored to Aldwych until July 1946.

Postwar, occasional proposals to extend the line to Waterloo and beyond came to naught, and towards the end, patronage had dwindled to about 450 trips per day. With a service interval of nine minutes, it was quicker to walk to or from Holborn. The need to replace and modernise the lifts precipitated the station's permanent closure with the last train running on 30 September 1994.

#### A subterranean visit

After the mandatory health and safety briefing by TfL staff in the booking hall, Richard gave us a short historical introduction to the station. Elements of the booking hall are original, most obviously some of the tilework, the telephone booths, the first booking office



The Elgin Marbles being moved back to the British Museum from Aldwych station during the winter of 1948. They did not go back on public display until 1962

and the Otis lifts (unique, but non-operating survivors), together with the Art Nouveau ventilation grilles above the lift entrances. The shafts are 110 feet (33.5m) deep and were hand-dug. However, with no lift service any more, we would have to walk down (and back up) the 131 stairs.

En route to the spiral staircase, approached by a flight of steps from the booking office, we inspected an incongruous vault. This is all that remains of the former Royal Strand Theatre, demolished in 1906 to clear the site for the building of the station. Descending the spiral staircase, we admired the intricate pattern of tiling and, on reaching the basement lift landing, the elegant mouldings around the lift entrances. A key





was produced and a gate opened, giving access to the bottom of one of the lift shafts. These displayed their solid construction of bolted cast-iron sections, receding upwards far above our heads



The group on the lower lift landing where our knowledgeable guide Richard West told us more of the history of Aldwych.  
Photo Jonathan Schneider



A rare glimpse of the unfinished other side of the lower lift landing. This is not part of the normal public tour. Photo Tim Wellburn

Crossing the bottom of the shaft, we emerged in the unfinished and long abandoned second landing. This is not on TfL's public tours, but Richard had secured special dispensation for SubBrit! Here, in contrast to the fine plaster work of the finished landing, we could inspect the underlying iron, concrete and brick structure. The access to the related, unfinished passages at the eastern end of the landing was bricked up: we would inspect these later.

### We go underground

Back in the 'operational' lift landing, the luminous guidance strips along the passageways were demonstrated to us by the simple expedient of extinguishing the lights. (This is not something TfL normally demonstrates to visitors.) We then headed to the western (originally number 1) platform where we were surprised to find the 4-car shuttle photographed by Nick Catford in September 1992 still waiting for us. However, time does not quite stand still down here: the posters on the platform wall may look period pieces, but they are a movable feast, depending on what was last



The winding passage leading from the lower lift landing to the stairs down to Platform 1. Nothing has changed here since closure in 1994. Photo James Buller



Looking along Platform 1 towards Holborn. The 4-car shuttle is kept in the platform. It is still in full working order and can be used when required by film companies. Photo James Buller

being filmed 'on location'. James Bond visited a couple of times in different guises for *Die Another Day* and *Skyfall*. (He had also dropped in on the former Jubilee line platforms at Charing Cross – which some of us had seen on a previous SubBrit visit.)

We then crossed back up and over the tracks to the long abandoned (eastern) Platform 2. There was no train here – and had not been for nigh on a century, when the



The group in the overrun tunnel at the south end of Platform 2.  
Photo Jonathan Schneider



platform was sealed off during the Great War. It does, however, still have the original track, complete with rare Grade 1-listed insulators. The track structure here also predated the introduction of the suicide pit.

Another rarity is the archaic buffer stop: it did not look as if it would have provided much retardation before the train hit the end wall. This was located at the end of the unlit, iron-segmented overrun tunnel, which we were permitted to examine in another authorised extension to the standard tour.



The buffer at the end of the overrun tunnel. Photo Nick Catford  
Platform 2 is also something of a time-warp. As with Platform 1, three-fifths of the length of this platform was never used or tiled but, in the section that was, parts of the original tiled STRAND lettering are still visible. These tiles must have been hand-made, with a single letter extending over ten or more tiles, all in perfect alignment.

However, while this platform never formed an operational part of the renamed Aldwych station, parts of it have metamorphosed more radically, having been used since the 1930s as a test bed for the design of new station styles and equipment upgrades. Mock-ups of Bond Street, Piccadilly, Oxford Circus and Holborn stations are still identifiable, at least by Underground aficionados.

From the identity-challenged Platform 2, we moved on to explore the dark and atmospheric unfinished foot tunnels. These run from the second lift landing (with a spur off to access the spiral staircase) to the southern end of each platform, and were intended as the entrance routes. The flight of stairs down to Platform 2 is now sufficiently dilapidated to be out of bounds even to SubBrit.

### Onwards and Upwards

After ascending the spiral staircase, we had time for a second look at the booking hall and to examine the lifts,



Platform 2 with original track still in place.  
Photo Jonathan Schneider



Richard West and the group in the unfinished subway linking the lower lift landing to Platform 2. Photo Jonathan Schneider

noting the ghostly traces of the ticket kiosk where we would once have surrendered our tickets. We were able to step through the unobtrusive emergency exit which connects the two lift cages, with only a small gap, through which the bottom of the shaft was just visible, far below us. We left the station at the Surrey Street exit – as the GN&SR had originally intended its passengers to do.

Our thanks are due to Richard West for organising and leading the visit, and to the TfL support team, who ensured that we did not emerge at Holborn, by mistake (or otherwise). Rumour has it that there may be a repeat visit in the pipeline: watch for announcements!

\* *The GNP&BR Strand station was renamed Aldwych in 1915 to avoid confusion when the adjacent station on the Charing Cross, Euston & Hampstead Railway at Charing Cross became Strand. This latter, on what is now the Northern line, was renamed Charing Cross in 1979.*

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# Scottish Bunker Road Trip: 26–28 September 2014

Mark Dalton



The Cultybraggan bunker in February 2011. Photo Nick Catford

On the weekend of golf's Ryder Cup at Gleneagles, the last place you'd want to be is in a bunker... unless you're a member of Subterranea Britannica! Thanks to three generous owners – themselves also Sub Brit members – three Scottish Cold War Bunkers were open to view on the same sunny weekend. These represented the three most significant types of large Cold War bunker – Government Headquarters (Cultybraggan), ROC Headquarters (Craigiebarns) and ROTOR Radar (Anstruther). In various states of preservation, they made for a fascinating road trip.

I picked up fellow Sub Britter and ROC Post restorer Andy Ramek at Birmingham International train station on Friday afternoon and we headed north via the M6. Traffic queues around Manchester were soon consigned to the rear-view mirror and the open spaces of Cumbria beckoned. Once over the border, a large police presence and temporary 20mph speed limits (due to the Ryder Cup) slightly delayed us, but by 8pm we were in the bar at the Dundee West Premier Inn.

Fellow SB members were making the trip from right across the UK. As well as local members, home addresses included Brighton, Newbury and even Exeter in Devon. All the sites were 'free-flow' so we didn't meet as a single group but the relaxed pace gave us lots of time to chat as we bumped into each other.

## Cultybraggan

Next day we were up bright and early to drive west to our first destination, Cultybraggan RGHQ (Regional Government Headquarters) near the village of Comrie in Perth and Kinross. We arrived on a fresh and sunny morning just after the official start time of 10am. The bunker site is reached by driving through the old Cultybraggan Army Camp. The camp itself is dominated by rows and rows of Nissen huts, some well-maintained and others showing signs of their age, for the camp was originally built in 1941 as a prisoner-of-war camp and most of the buildings are now over seventy years old.

Although the army continued to use the camp until 2004, it felt like we were walking through the set of a World War II escape film. The camp and bunker were purchased by the Comrie Development Trust in 2006 and they are working to use the site for small businesses, community groups and allotments which now populate the assault course!

The bunker, which has now been sold on, is to the rear of the camp in its own fenced compound. Entrance is through a gate into a grassed compound with what appears to be an electrical sub-station just outside. The bunker itself is a relatively low-key grassed mound with a central entrance way leading in. A large bank of air inlets sits on the top rear of the mound and a communications





Air intake and exhaust towers on top of the bunker mast stands nearby. It was a very late construction for the Cold War, built in the late 1980s and operational just from 1990 to 1992.

We met Brandon Butterworth, the new owner of the bunker, outside the main entrance and had a good chat with him before Linda and Martin Dixon arrived. This became a recurring theme as (perhaps unsurprisingly) we continued to bump into Linda and Martin throughout the rest of the weekend.

We did not have high hopes for the interior of the bunker as we were well aware that there had been a break-in by metal thieves in the recent past. However, we were pleasantly surprised when we entered as the bunker had not experienced any severe vandalism (with the exception of a few smashed basins in the toilets) and seemed to be in generally good condition, although with no power or lighting.

### Decontamination

Entering the bunker, the first memorable feature was the thick armoured-glass windows of the guard room area. Inside the room was a free-standing control panel which



One of the large open-plan rooms on the upper floor. This view is from February 2011 when the lights were still working. Photo Nick Catford

was strewn with keys for the various areas of the bunker – these had obviously been originally stored on the key racks mounted on the walls. Close to the guard room were both ‘clean’ and ‘dirty’ entrances, the latter leading to a substantial decontamination suite. Stairs led down to the lower bunker level (the upper level is mounded with earth, while the lower level is completely underground). In the upper level of the bunker there was a large empty open-plan office space. This was by far the largest area of the bunker and it was easy to imagine that had the lights been on this could have been any modern office environment. By now lots of other members had arrived and so the illumination was by torch and head-light instead.

A further large room with a room divider was situated to the left of the main room with toilets running down the remainder of this side of the bunker. On the opposite side of the large main room were smaller rooms, although there was little clue to their purpose. They would have housed specialist support teams from the military and from civilian groups such as the emergency services and meteorologists. One of the side rooms was being used to store what looked to be some outdated electrical cabinets while the only other remaining item of interest was a large safe which was on a table in the main open-plan office.



Filter units in the upper level plant room

Beyond the main office space was a large plant area which ran across the rear of the bunker. This contained all the air-handling plant including filter banks and control panels. A double-height concrete chamber dropped down to the lower bunker level and what appeared to be a large blast valve was situated nearby. A second exit to the bunker could be found here along with another set of stairs down to the lower level and an anteroom which still contained decaying boxes of filter inserts. All the equipment seemed in good order and the various inspection stickers all had dates between 1990 and 1992.

### Heading downwards

Moving down to the lower level dropped you to the lower plant-room. This room was relatively sparse compared to the upper plant-room but still contained control panels, fire suppression kit and a large water tank. An interesting feature was a water barrel with a small feed-line into



the water supply – presumably to add some sort of disinfectant to make it safe for drinking.

The generator room was off to the side of this room. Here it was clear where the metal thieves had been at work as the generator cables had been cut and the cabinets stripped. This was the worst affected area from the break-in; however, as Brandon stated, a lot of other items had gone as well, it just wasn't as obvious.



Air-conditioning plant room on the lower level

Exiting the plant room on the lower level there was a long corridor with what appeared to be dormitory rooms off to the left-hand side down most of the length. On the right were a number of passageways that led off to the BBC studio, a strong room, a medical room and various other rooms with unknown uses. The BBC studio had metallic panels to provide soundproofing, unlike the composition tiles usually seen. At the far end of the corridor on the right-hand side were the canteen and kitchen areas. These still contained a number of stainless steel ranges and large items of cooking equipment.

### Damp underfoot

The bunker was carpeted throughout the office areas, although the lower-floor carpets were soggy with water and squelched underfoot. In several of the lower-level rooms the carpets had been pulled up as they had become saturated. Many of the doors on the lower level were chocked open and this seemed to be helping disperse the water. Overall the bunker was in much better condition than we expected and it was very interesting to see how

the bunker was arranged. It was essentially optimised for office working, with the plant rooms positioned at one end of the bunker and the main working areas on the upper level. The personnel facilities including eating, sleeping and medical were all located on the lower level.

Having been to numerous ROTOR bunkers modified for later use as Regional Government Headquarters, it was refreshing to see what had been achieved when the planners were allowed to develop a protected RGHQ from first principles rather than have to shoehorn the needed facilities in to the labyrinthine 1950s ROTOR interiors.

To finish off the visit we had a quick look at the Comrie ROC Post, which is well secured just outside the main bunker compound. Although it was locked, the mounts for all of the post's instruments could be seen and Andy and I explained their use to members who hadn't seen an ROC post before. We finished with a drive around the camp, before heading off to our next location, the former ROC Group and Sector HQ at Craigiebarns.

### Craigiebarns ROC Group and Sector HQ

This bunker is in the Dundee suburbs and was easy to find within a small housing estate off the Craigiebarns road. The location had originally been a centre for a number of volunteer organisations affiliated to the military, and the original signpost can still be seen directing traffic off the main road and up the hill to the ROC control. Sadly, the only organisation still extant is the local Air Training Corps unit, which occupies a building to the south of the old ROC area.



The canteen – the serving hatch from the kitchen is seen on the left



The kitchen still contains much of its stainless steel equipment



The kitchen now restored and fully equipped

The bunker itself is in the eastern corner of what is now a housing estate. Craigiebarns House still stands on this side of the estate and was used by the authorities when the ROC was still operating. We were later shown pictures of the extensive training and storage buildings which were attached to both the bunker and the house and which were ultimately demolished to make way for the housing estate.

In their wisdom the estate's builders had gifted the bunker to the Civil Defence and Emergency Service Preservation Trust for £1 as the cost and effort of demolishing the bunker would have been prohibitive. The one concession to appearance was that the builders removed the 'pagoda' roof structures of the bunker and fabricated a traditional roof so as to blend in with the new houses.

The door was locked when we arrived but a quick knock and we were welcomed in by Gavin Saxby. Gavin was a fabulous host and gave us a very thorough and enjoyable tour of the bunker. His enthusiasm and knowledge of the site, its equipment and workings was infectious and having seen only a few website photos, we were hugely impressed with what had been achieved by him and the team.

The bunker had started life as a typical semi-submerged Group HQ but had been developed into the Caledonian Sector control by the addition of a number of further rooms on the lower (underground) floor. The Group HQ part of the bunker had continued in its original use but in later years the area overlooked by the balcony was boarded over (a similar effect was created at Preston Sector control with the building of offices in the lower part of the main Group ops room).

### Post reporting

The balcony area has now been completely restored with the triangulation area and post equipment all in place in their assigned areas. We were able to identify on maps the post at Comrie that we had recently visited and spot its place on the reporting boards around the balcony edge. Gavin and team have plans to establish communication links with ROC posts so that the whole reporting and alert process can be recreated.

A set of stairs leads down from the rear of the balcony area to the later Sector control area (this can also be reached from the canteen/dining area). The Sector control area is the heart of the bunker and has the Display A & B backlit perspex boards in place for the plotting duties of the Group Control side by side with the Sector Control boards. A raised dais looks out onto these and there are numerous phones, communications kit and annexes filled with maps and equipment. There



The Group Operations room as seen from the Post Supervisor's position on the fully restored balcony. You can see the nuclear burst tote on the left and the post situation boards straight ahead. On the desk in front of you are 5 voice procedure training sets



The triangulation area at the rear of the balcony

are further rooms off this main ops room, including a dormitory for the sector team to 'hot bed' in when not on duty. One particularly satisfying aspect was to see the new carpet that had been laid by volunteers but purchased with the help of a donation from Sub Brit: money well spent.



The Sector Operations room. Linda Dixon places an air burst marker on Display T just to the south west of York. Extra, green markers were used for air bursts and red markers for ground bursts which produced significant amounts of fallout which would need to be plotted with chinagraph pencil on the display



The level of detail and equipment throughout the bunker was a revelation and Gavin and the team should be immensely proud of what they have achieved at Craigiebarns. Despite the fantastic restoration, the item that most impressed many Sub Britters was the fact that if you stuck the bomb symbols on the perspex map boards, the fluorescent light positioned around the display-board edges would cause the symbols to glow brightly – simple things...

### **Anstruther**

Following an evening in Dundee we set off for our final destination on the Sunday morning. This was the ROTOR GCI station at Anstruther, now more commonly known as ‘Scotland’s Secret Bunker’.

Prior to the bunker, we made a slight detour to take in another Cold War location, the airfield at RAF Leuchars. This had been the base for the Northern Quick Reaction Alert (QRA) Force and had scrambled fighters to intercept Soviet bombers for decades (a Phantom and Tornado still stand as gate guardians at the main entrance). RAF Typhoons operated from the base on QRA until earlier this year but have now sadly moved to RAF Lossiemouth further north, and Leuchars will be turned over to the Army soon.



The Anstruther guard house was built of local stone to blend in with other buildings in the locality. Photo Dave Cleghorn

The arrival at Anstruther is similar to a number of the old ROTOR sites – a road appearing to lead to the middle of nowhere in fact leads to a vaguely sinister single-storey bungalow. However, at Anstruther it is clear that the bungalow is military-related due to the number of tanks, guns and military kit that are displayed outside in the bunker grounds. We spotted a ‘Green Goddess’ fire engine, an Abbot self-propelled gun and a surface-to-air missile launcher.

The bungalow is now used as a shop rather than a guard-house, with the entrance to the bunker via the usual staircase extension down to the familiar sloping tunnel. We had visited the bunker around five years ago and little had changed with the exception of the addition of visual display equipment positioned throughout the bunker. These scrolled through historic pictures taken of the bunker before it was restored and were quite effective

in showing how the spaces had originally looked. It was explained to us later that the displays would ultimately provide a lot more interactive information but that they were still ironing out some teething problems.

### **Bunker Exhibits**

The bunker has a mix of exhibits with a clear focus on ROC operations. The top floor has a mocked-up ROC control centre and actually has a lot of the equipment that was originally used at Craigiebarns and was saved when that closed down. Gavin Saxby and his team have since worked with the Anstruther team to make exact copies for the Craigiebarns control.



The ROC control room. Photo Katy Borlucie

Other rooms are used for various exhibits on the Cold War and, credit should be given, one room is used to provide anti-nuclear campaign information. At the time of our visit it was only a week or so after the Scottish independence vote and a number of leaflets were available in this room supporting the ‘yes’ vote as a vote to rid Scotland of nuclear weapons.

Downstairs was the largest exhibit room which included ROC perspex display boards plus mock-ups of government departments (the bunker had been used as a SRHQ after the ROTOR system died away) overlooked by various admin and controller positions.



Mock-up of a Rotor operations room

Further rooms contained radar equipment and a recreation of a fighter control room, complete with tote board. For the Sub Brit team, the best part of the visit was a chance encounter with Martyn Dawson, who as well as working



Mock-up of a Government control room. Photo Graeme Davidson

at Anstruther is leading the Barnton Quarry restoration. Martyn was kind enough to take some of us to areas of the bunker out-of-bounds to the paying public.

We first went into the main plant room on the lower floor and were given free rein to climb up to the machinery and pipe spaces above the main plant. We then all squeezed through several doors at the back of the room and ended up in between the still-operating filter banks. After extracting ourselves Martyn then showed us the sewage ejector area which led us into the emergency exit stairs. Various food storage freezers are kept in this area for the canteen and resulted in the predictable comments re post-apocalyptic disposals.

#### **A worthwhile weekend**

All in all the weekend was a great success and it was unfortunate that hotel costs and potential traffic delays caused by the Ryder Cup appeared to have deterred a bigger turnout. Nevertheless around thirty members enjoyed the visits and



The air-conditioning plant room.

This is not part of the normal public tour

it was a welcome 'local trip' for several Scottish members. For Andy and myself, we found the hotel in Dundee was reasonably priced and we suffered no major golf-related traffic issues. The weather was superb and we were able to eat outside in bright sunshine. The bunkers themselves were all fascinating in different ways and to see three built for different purposes in different eras was a great insight into the development of such structures and their uses. Good luck to all the owners / restorers.

I'd like to thank Nick Catford and Sub Brit for organising the visits; Brandon Butterworth for access to Cultybraggan; Gavin Saxby and team at Craigiebarns; James Mitchell for allowing Sub Brit free access to Anstruther, and Martyn Dawson for giving us a 'behind the scenes' tour. Finally thanks to Linda, Martin and Eric who were continually entertaining and informative every time we bumped into them.

Photos Mark Dalton unless stated

## **A 16th-century tunnel at Coombe Hill, Kingston-upon-Thames, Surrey**

In or shortly after 1514 Thomas Wolsey [1475 – 1530] acquired the use of land for his new palace, Hampton Court, on the north side of the River Thames. This extensive range of buildings, when completed, had cold (but not hot) running water available 'on tap' from springs at Coombe Hill near Kingston-upon-Thames, the other side of the river. Water was conducted to the palace through a three-inch diameter lead pipe laid in a trench and buried, and across the bed of the river, a distance of over three miles. As the springs were at a higher level than the palace, no pumping was needed. Several springs were tapped, each enclosed by a collecting basin in one of three 'conduit houses', called the Gallows, Ivy (or Bush) and the Coombe conduit houses. The first and last of these consisted of upper and lower buildings, and the Coombe Conduit House (the most interesting one) is kept in good repair and is open to the public from time to time.

The 'houses' are neatly constructed of stone and brick, with their lower parts below ground level. Small feeder tunnels about two feet high lead into them, and upper and lower Coombe houses are linked by a tunnel 81 feet long,

five feet four inches wide, and from seven feet nine inches to ten feet six inches high. The floor falls nine inches toward Hampton Court. The system remained operational until 1876, and the legalities attaching to it were all wound up in 1900.

A description in the journal of the Surrey Archaeological Society includes a map of the pipeline, and measured drawings and photographs of the exteriors and interiors of the conduit houses and tunnel.

The site is managed by the National Trust, although that body's Members' Handbook provides no exact details of location or opening times. The house stands in grounds on Coombe Lane on the outskirts of Kingston, occasional opening times being advertised locally and presumably on the NT website [www.nationaltrust.org.uk](http://www.nationaltrust.org.uk) or [enquiries@nationaltrust.org.uk](mailto:enquiries@nationaltrust.org.uk)

**SOURCE:** FORGE, J.W. Lindus, 1959, Coombe Hill conduit houses and the water supply system of Hampton Court Palace. Surrey Archaeological Collections 56, 3 – 14 including two folded pages of measured drawings and plates i – v.





# Underground Fuel Tanks in Dover

Chris Rayner

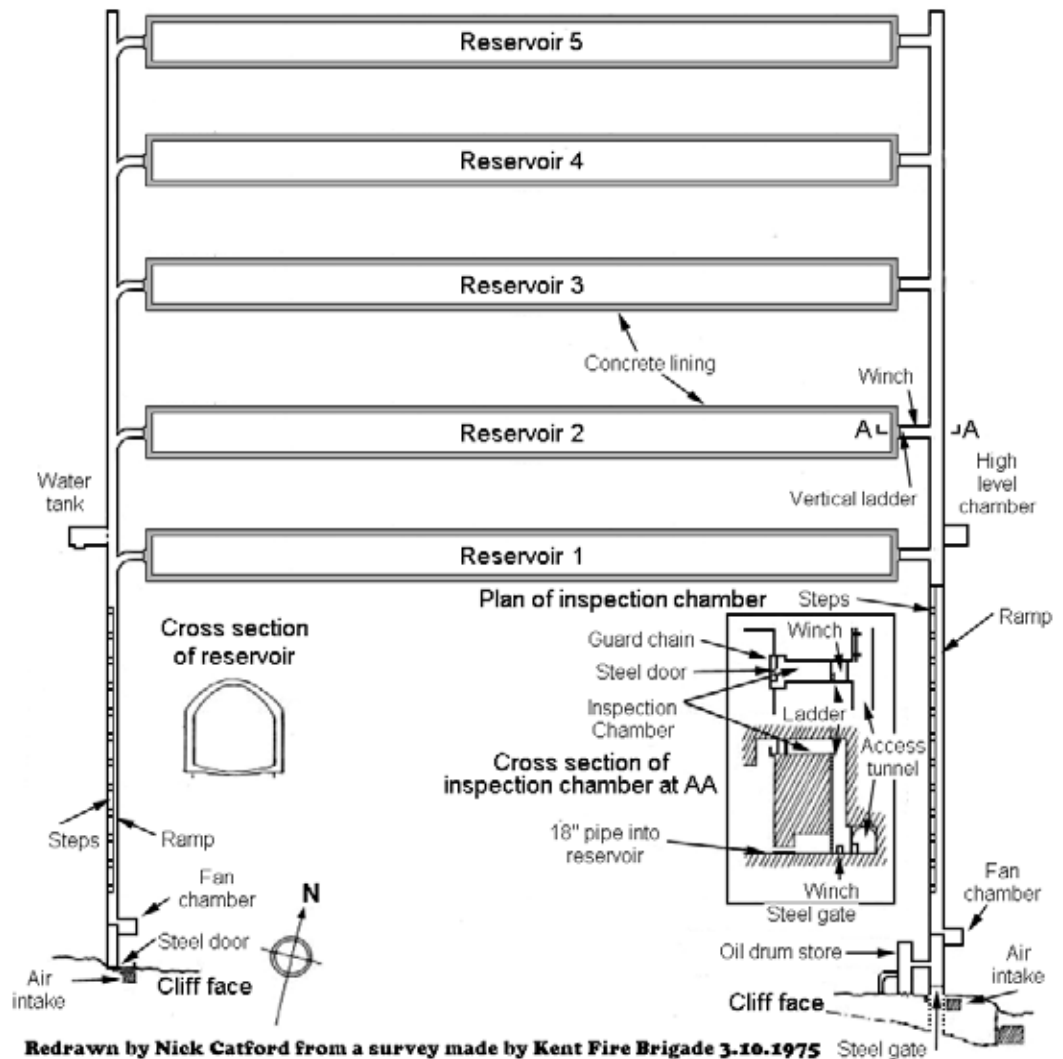
As the likelihood of war increased in the late 1930s, large buried fuel tanks were built at several naval bases to act as protected emergency reserves in case surface tanks were destroyed.

At Dover, five enormous barrel-vaulted tunnels were excavated high up in the cliffs, each one 180m long. Measuring 9.9m wide by 12.2m tall at their highest point; they were set one behind another aligned parallel to the cliff face. They were lined with concrete and were connected at each end to pipe and personnel access tunnels running down towards the harbour.

They were built to store naval fuel oil, as oil burning warships had almost completely replaced the coal burners by the 1930s.

Four of the tanks at Dover were built to hold furnace fuel oil, a viscous almost tarry oil favoured by naval ships, while the fifth, the one closest to the harbour, held diesel oil. Each held just under 19 million litres.

The contract was won by Sir Lindsay Parkinson and Co. (now part of AMEC) and work commenced in March 1939, six months after the Munich Crisis. The first stage was to



build the 2.4m high access tunnels, a 1.8m wide one to the west of the tanks and a wider east side one 3.0m wide. The access tunnels had concrete lined entrances and rubber-sealed steel blast doors. At the start of each tunnel was a small ventilation plant room housing a fan, which by reversing its direction, could operate as both air intake and extract as the occasion demanded.



The east entrance



The steps and ramp down to the harbour





Control chamber for tank No. 3. The 12.2 metre ladder to the upper platform is seen adjacent to the winch. The access tunnel is on the right



Fuel pipe inlets to Tank no. 5

Long staircases lead up to the tanks, which are raised above harbour level to allow them to empty under gravity and refuel ships even if power supplies were severed. The larger access tunnel staircase has 180 steps in twelve flights and would have had ventilation and drainage pipes laid down one side, while the oil supply pipe would be housed under the adjacent 2.1m wide ramp. During construction there would have been a conveyor belt on it on which cement, sand and ballast would have been conveyed up to a mixing area beside the tanks and down which spoil would have been removed. The tunnel entrance would have been heavily camouflaged by netting to conceal all traces of the excavation and building works. In the smaller tunnel, the area where the concrete was mixed can be seen and the overhead water tank that fed the mixer is still present, however in the large tunnel this has been backfilled.

At the top of the stairs, an upper-level tunnel runs past the ends of the five fuel tanks, with opened out control chambers containing the tank access, monitoring and operating equipment. Within each tank is a long fuel pipe which can be raised or lowered by means of a winch in the control chamber.

When the tank is to be filled, the 0.45m diameter oil feed pipe is raised above the tank fuel level, and when it is to be emptied, the pipe is allowed to sink below the fuel level.

The fuel gauge operates in the opposite way to the fuel level – it is low when the tank is nearly full and high when it is nearly empty.

A painted contents board beside the fuel gauge showed the current fuel tank state.

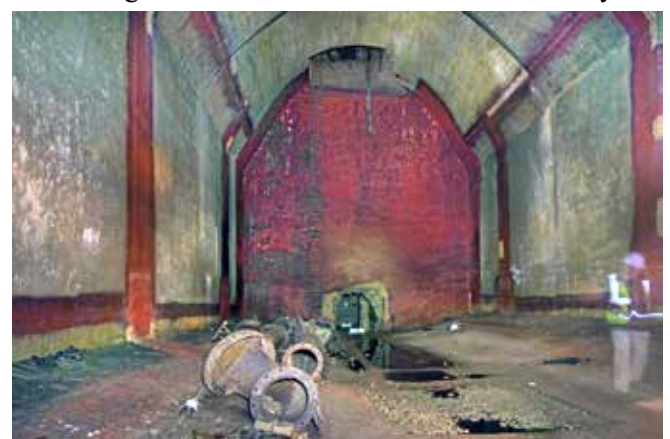
Access to the fuel tank was via a 12.2m high ladder at this point too. At the top of the ladder a platform led 4.5m over the east wall of the tank to an airtight door. Once the upper level of the tank was accessed, another ladder led down

to the tank floor. Today access is a little easier as the end of the tank no. 4 has been breached.

Entering the tank one is struck by its enormous size, and the colours are also very surprising. The floor, walls and roof appear to be stiffened with projecting reinforced concrete ribs, and the roof vault is echoed to a lesser degree by the dished floor. The latter would have helped with tank emptying, but despite that, some small puddles of oil remained. The west end though is different, and has a flat raised platform and riveted steel plating for an unknown reason.

Work was only completed in 1944 and after the war the tanks were leased to Esso, only being decommissioned in the 1960s. Their potential postwar importance can still be seen in the Dover Harbour Consolidation Act of 1954 which codified the Admiralty's interest in them, at which time they were called the 'Underground Oil Fuel Installation'.

The Invergordon naval base in the Firth of Cromarty had



The east end wall of Tank no. 4 adjacent to the wide personnel tunnel showing the post war breach. The ladder leads to the inspection chamber at the top of the tank

a similar arrangement of fuel tanks buried in a hillside 4 miles away at Inchindown. Five of its six tanks were 237m long, a third longer than Dover's because the Firth was likely to be a safer and thus busier anchorage than Dover, containing more and larger vessels. These larger





Inside tank no. 4 – part of the dismantled fuel pipe rests on the floor tanks could each hold 25 million litres of furnace fuel oil. Construction here was completed much quicker, and

the tanks were ready by February 1941.

Although gravity feed was possible from the Inchindown tanks to the harbour, pumping stations were needed to allow them to be filled and electric heaters were provided at intervals along the route to improve the viscous oil's flow rate.

Underground fuel tanks were also built at Portsdown, near Portsmouth, although here there were nine tanks 10.6m high, two thirds of which were of similar capacity to Dover's, while six Dover-sized tanks also survive at Lyness in the Orkneys.

Full details of the Inchindown depot may be found in *Subterranea 24* (September 2010), pages 22 – 30

All photos Chris Rayner

## Subterranea Britannica

### Study Weekend: Hamburg 2015

Saturday 16 May – Monday 18 May

Our European excursion this spring is to the city of Hamburg, with the help of members of local groups Hamburger Unterwelten and Unter Hamburg. You should plan to arrive in Hamburg on the Friday evening so that the visits can start promptly on Saturday morning. Saturday and Sunday are planned to be day-long site visits with Monday being free for optional sites (eg Miniatur Wunderland) and return home. You will be responsible for your own travel to and from Hamburg.

The list of sites is not finalised yet, but we expect to select from:

- The Elbe Tunnel
- World War II Air-Raid Shelters
- WWII Flak Tower
- Cold War Bunkers and Hospital
- The U-Bahn (part of which is elevated) and S-Bahn (partly underground)!
- Victorian Brewery Ice House
- Remains of U-Boat Pens

Our estimate for the weekend is approximately £280, to include Friday, Saturday and Sunday nights B&B, lunches & dinners on Saturday & Sunday, entrances & guide fees, brief site notes, and public transport around Hamburg. The hotel single supplement will be about £90.

We plan to stay at the Motel One Hamburg am Michel (Ludwig-Erhard-Straße 26, 20459 Hamburg)

#### **This year we will be taking bookings online.**

- All attendees must be members of Sub Brit for insurance purposes.
- Log on to 'mySUBBRIT' at <https://mysubbrit.org.uk> and then click on 'Register for event'.
- Bookings will open at 0900 on 11 January 2015.
- We will also open a discussion thread on the Members' Forum called 'Hamburg Weekend' under the Events Category.

When you book you will be asked for the following:

- type of hotel room (single, double or shared).  
Note that if you want any extra nights in the hotel you should book these yourself;
- any food preferences (vegetarian, gluten-free etc.);
- to pay a deposit of £50, preferably by PayPal. Full payment will be requested at the end of March, by cheque (to avoid excessive Paypal charges!).

Acknowledgement of your booking will be by email. Full joining instructions will be sent just before the trip.

**If you cannot access the internet**, send your name, address, phone number and preferences as above, with a cheque for the deposit for £50 (payable to Sub Brit) to Linda Dixon, Heathend Cottage, Windsor Road, Ascot SL5 7LQ.

Mark your envelope 'Hamburg'. Send an SAE for acknowledgement.

You should have a reasonable level of fitness to attend the trip.

If you have any queries email [info@subbrit.org.uk](mailto:info@subbrit.org.uk) or contact Linda on the address above.



## Foot Tunnels beneath the River Thames

Dr Mary Mills (Chair of Friends of Greenwich and Woolwich Foot Tunnels)



The northern end of the Greenwich foot tunnel was damaged by bombs during WWII. It was repaired using a thick steel and concrete inner lining that reduces the diameter for a short distance. Photo Andy Kirby

Crossing the Thames east of the Tower has become a hot topic in recent years. Arguments are raging about plans for a third road tunnel crossing at Blackwall; there is a major campaign against this and numerous suggestions for alternatives. Proposals are not only for new crossings with tolls on them, but to start tolling the existing Blackwall crossing – and for the Free Ferry to be moved or removed and in either case to cease to be free. East of the Tower there were no crossings, other than ferries, until the late 19<sup>th</sup> century and we have to thank newly formed public bodies for a series of underwater tunnels by which people could cross the river safely and freely.

### Free river crossings east of the Tower

We take for granted free crossings by upriver bridges, but until the mid 19<sup>th</sup>-century many of these were tolled and it was money from the City of London's Coal and Wine dues which bought out the tolls and made the bridges free. It was seen that there was a need for crossings east of the Tower but also that downstream bridges would be a hazard on the busy commercial river. Cross-river ferries existed, many with ancient rights, but there were sometimes accidents and increasing their number was seen as a potential hazard. Tunnels were clearly the answer and the development of technologies – particularly the Greathead shield – allowed these to be built more effectively. Public authorities would take the lead.

The Free Ferry at Woolwich had been commissioned and built by the Metropolitan Board of Works and opened, to great public rejoicing, two days after the demise of the board and its replacement by the new London County Council. The life of the old board had actually been cut short in order to allow the first meeting of the new County Council to approve tenders for the work to start on the new Blackwall Tunnel – the first of a series of new free river crossings for east and southeast London.



The Woolwich Ferry and adjacent south entrance rotunda to the Woolwich foot tunnel in the second decade of the 20<sup>th</sup> century.

Photo from Greenwich Heritage Centre

The Blackwall tunnel opened in 1897, followed by the Greenwich Foot Tunnel in 1902, the Rotherhithe Tunnel in 1908 and the Woolwich Foot Tunnel in 1912. It should





be noted that all of these tunnels allowed pedestrians to cross and that all of them were free to use. It is said that the provision of these tunnels – in particular that at Woolwich – owed much to the efforts of Will Crooks, who had been Chair of the LCC Bridges Committee in 1898 when, it is said, the foot tunnels were planned. From 1903 he was Member of Parliament for Woolwich, at a time when the Woolwich constituency covered both sides of the river and thus both tunnel entrances.

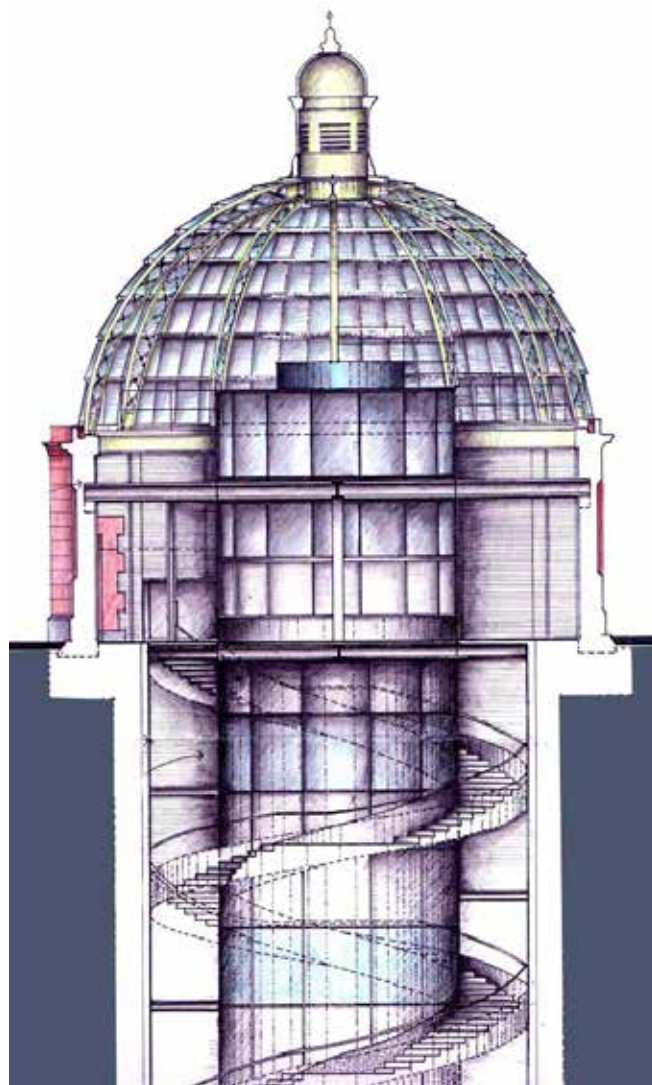
The arguments today are about crossings for motorised traffic – and for many years now the Blackwall has been restricted to motor vehicles and pedestrians and cyclists are banned. The Rotherhithe too is mainly a vehicle tunnel and the pedestrian entrances part way in are blocked. Two pedestrian tunnels still remain at Greenwich and Woolwich and only carry the pedestrian traffic for which they were built. Over the past couple of years they have been the subject of some concern and, indeed, controversy.

As far as we are aware these two Thames foot tunnels are one of only three or four sub-river pedestrian tunnels – all in Britain apart from one in Antwerp. They were built to allow access to north London jobs for south London residents and also to provide them with a free crossing. Today the tunnels are classed as public rights of way and are permanently open day and night. They are also part of the UK National Cycle Route 1 which links Inverness and Dover.

### The Greenwich Foot Tunnel

The Greenwich tunnel was the earlier of the two and a great deal more has been written about it than the later Woolwich tunnel. It was intended that it should replace ferry services which had enjoyed a statutory existence since 1676 and which owned the rights for the transfer of foot passengers. By 1900 the ownership of these rights was with the Great Eastern Railway Company and they, and the London County Council, acquired an enabling Act of Parliament for a foot tunnel in 1897. The Greenwich tunnel was designed by Sir Alexander Binnie and the contractors were J. Cochrane and Sons and work began in 1899. It opened in 1902.

Construction began with the sinking of a shaft on the north bank of the river in Island Gardens and advanced under the river to emerge in Greenwich by what was then the Ship Inn. As they proceeded underground they were to encounter

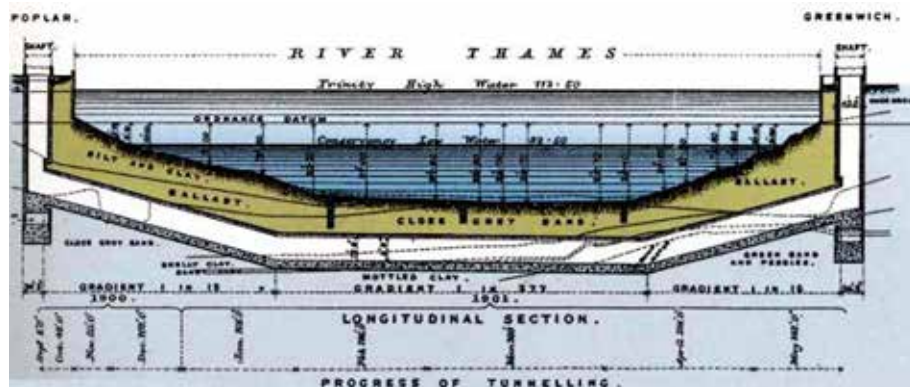


Section looking through the lift-shaft and lift-shaft building

various geological formations and their difficulties were recently put into perspective in a presentation to Greenwich Industrial History Society by geologist Dr Jackie Skipper. She is able to advise potential tunnel builders of what they can expect to find in a way which would have been unknown in 1900. Engineers then would have had to handle problems as they encountered them.

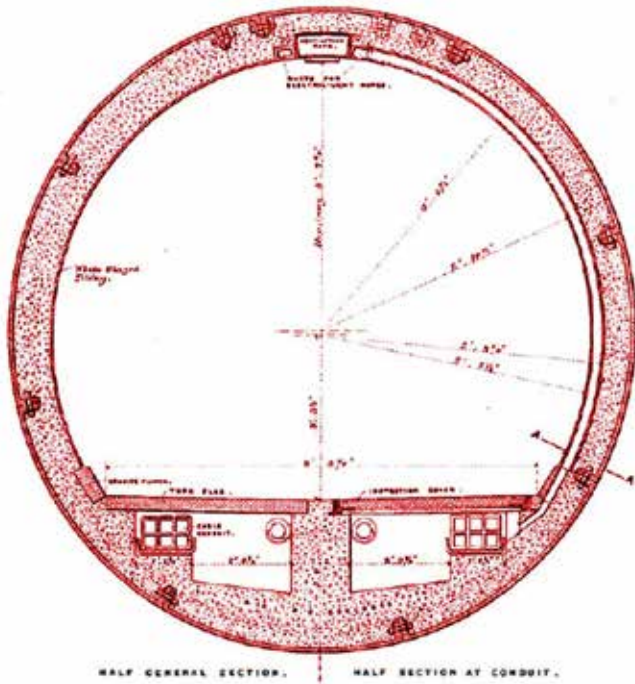
The tunnel is made up of a series of 32mm iron curved castings bolted together, lined with concrete and then faced with 200,000 white glazed ceramic tiles plus a stone kerb and a flooring of York stone. The tunnel itself dips towards the centre of the river with a gradient of 1 in 15.

These gradients were designed for the sake of economy and because the enabling Act of Parliament required that the depth of the tunnel should allow for dredging of the river at 48ft at high water. Great care was taken to make the jointing waterproof. Bolts had lead washers put on them completely filling any spaces and soft lead wire was hammered into the joints between castings.





THE GREENWICH FOOTWAY TUNNEL.



Tunnel section



Plaque above the south entrance doorways

The tunnelling shield used was 14ft 6in in length with 13 segments at the cutting edge, each segment with two 6-inch teeth. Care was also taken with the health of the men employed and new apparatus was designed to remove 'carbonic acid' from the air and also to ventilate generally. Messrs Leslie and Macmorran were the Medical Offices in charge and there was close monitoring of health and progress. It was noted that 'only nine cases of caisson sickness occurred, mostly trivial' and 'caused by indiscretion on the part of the sufferers'. It was hoped that the County Council could use the results which emerged from the use of this new apparatus to improve future works. A number of learned papers emerged from this initiative and results were published and studied. As the tunnel progressed it is said that the 'rate of progress has been exceptionally rapid' – 10ft per working day.

The tunnel is accessed via a shaft at each end in which there is now a lift and a spiral staircase— 88 steps at Poplar and 100 at Greenwich. These stairs are of wrought iron with brittle non-polishing cast iron tread plates. Originally the tunnel did not have

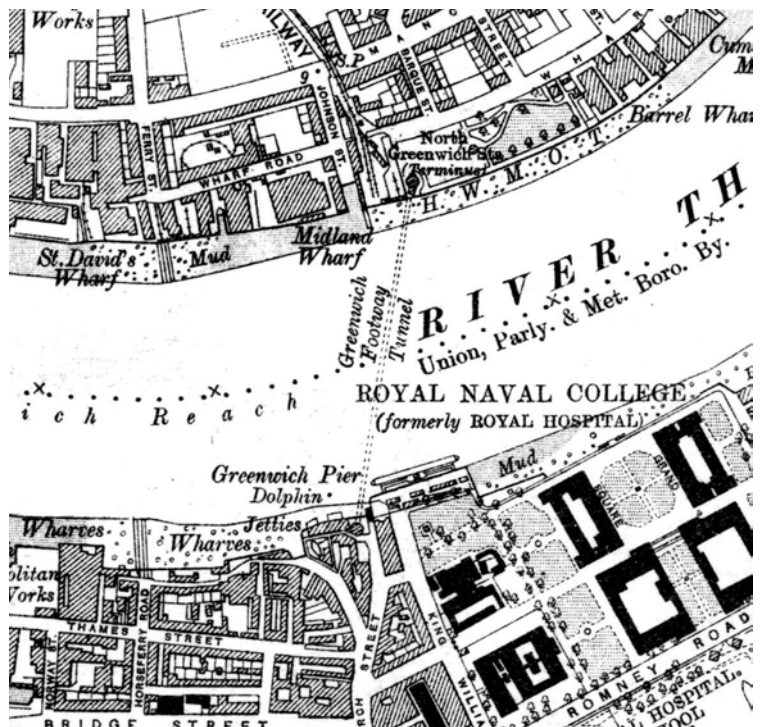
lifts; these were fitted in 1904. Access to the shafts is gained via a brick entrance rotunda below a glass dome. The walls of these rotundae are built over the outer edge of caissons which hold the shafts; the lift and stair structures hang from the caisson, and do not bear structurally on the horizontal surface at the base of the shafts. The caissons themselves are constructed of two steel skins 43ft in external diameter with four foot of concrete between outside and inside skins. A vertical stanchion stands in front of the lift doors and runs the depth of the shaft and ties stairs and lifts together. The lift motor rooms are housed on a floor above the lift shafts in the rotundas. In fact these motors are right under the glass domes, which has led to many current problems which will be described below.



The repaired section of tunnel looking north towards the lift. Photo Mike Peel

**Bomb damage during WW11**

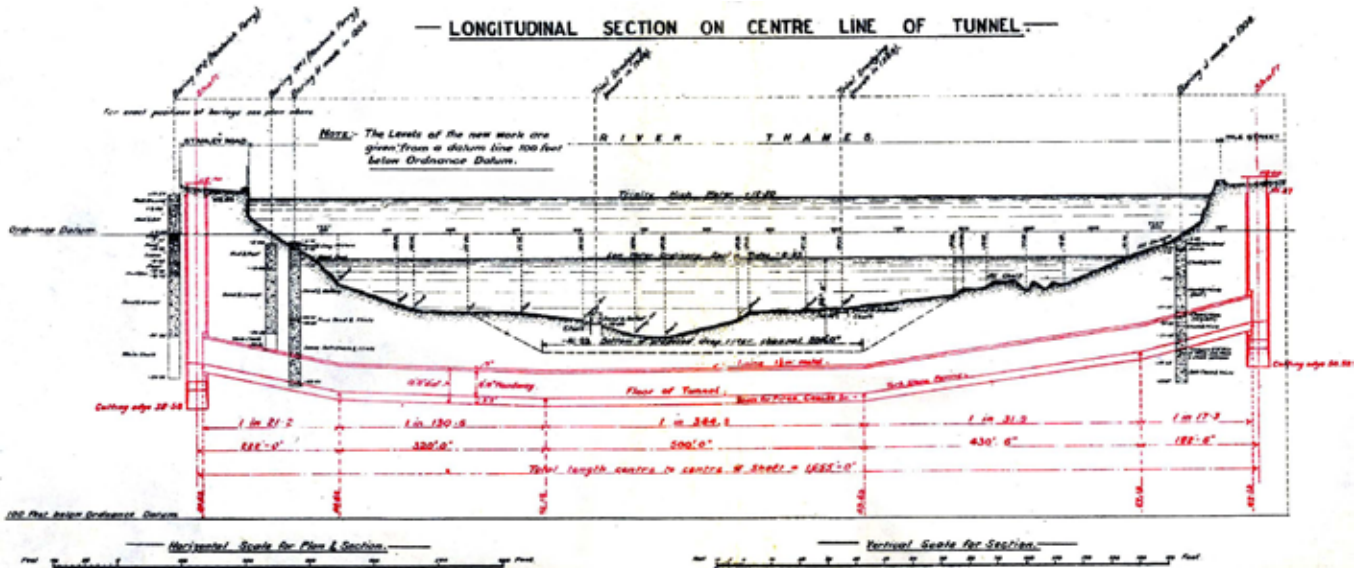
During the Second World War the Greenwich tunnel was bombed and a narrowed section near the north end remains lined directly with metal plates bereft of lining



1:10,560 OS map shows the Greenwich Tunnel with its south entrance rotunda at the end of Church Street and its North entrance rotunda adjacent to North Greenwich station (closed 4.5.1926)







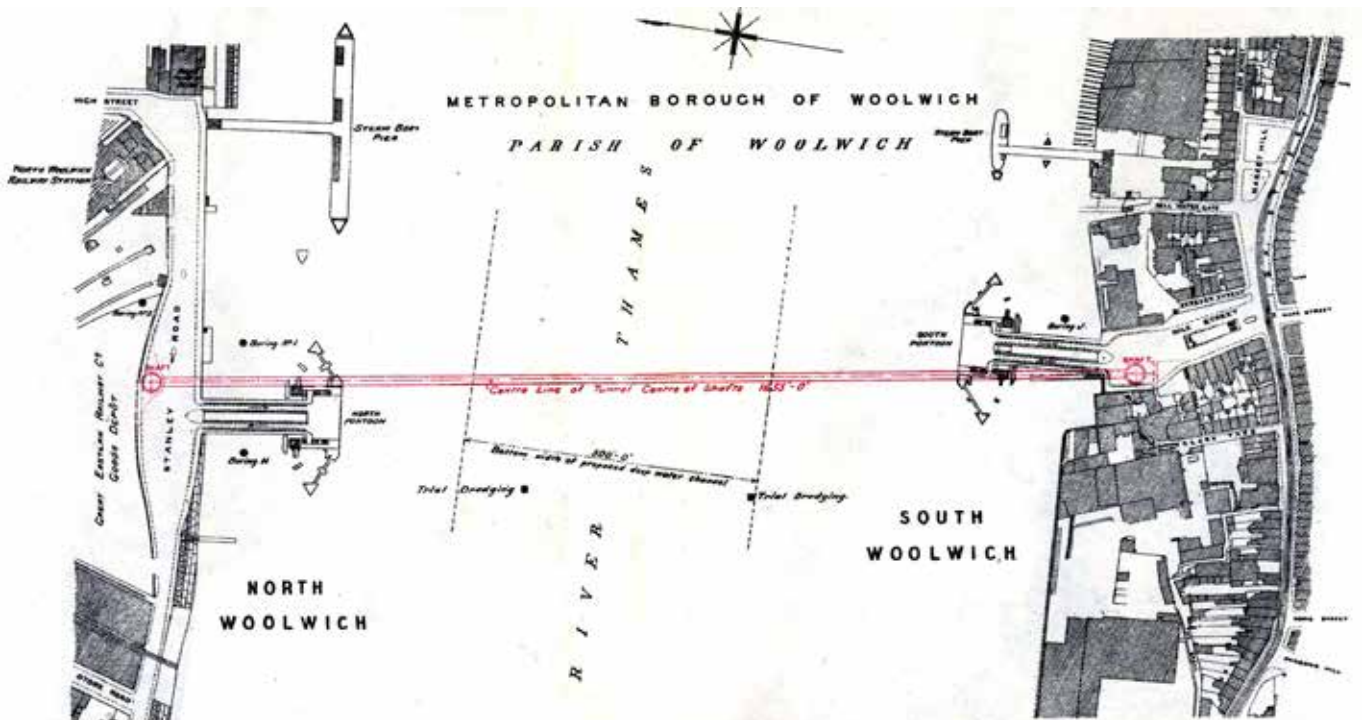
From Greenwich Heritage Centre

and tiles – the result of an emergency wartime repair. There is also shrapnel damage left unrepaired in the brickwork of the south rotunda. It is thought that the bomb which caused the damage inside the tunnel was on the foreshore of the north bank – and there were numerous hits on the south side, including rocket attacks. There has been some discussion as to whether the restricted section with its emergency repair should now be brought to the standard of the rest of the tunnel lining but it has been felt that this only too visible reminder of the Second World War is in itself a heritage item and should not be touched. The above ground parts of the tunnel are the small circular cupolae with entrances made of Stuarts Granolithic cement and ribbed glass domes above. Over the doorway at the Greenwich end is a bronze plaque which commemorates the completion of the work. These are now listed Grade II.

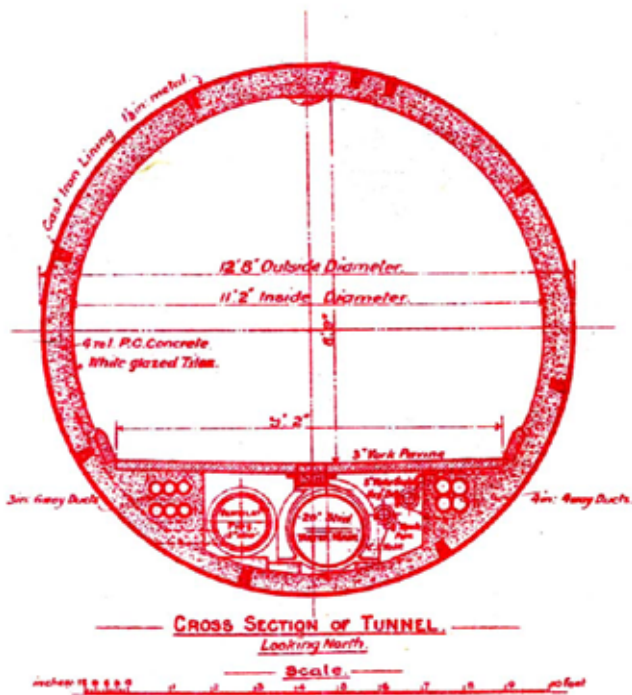
The London County Council originally managed these tunnels and this responsibility passed in due course to the Greater London Council. Following the demise of that authority in the 1980s Greenwich Council took over the management of both foot tunnels on behalf of the three constituent boroughs – Greenwich, Tower Hamlets and Newham.

### The Woolwich Foot Tunnel

There is much less detail available about the Woolwich foot tunnel, although it has much in common with that at Greenwich. It is suggested that the design of both originated with Alexander Binnie, although he was long retired when the Woolwich tunnel was built. The design engineer from 1901 was Binnie's successor, Maurice Fitzmaurice. The tunnel entrance originally sat on the Free Ferry approach – but access to the ferry was moved to allow for vehicle movements in the 1960s and a new



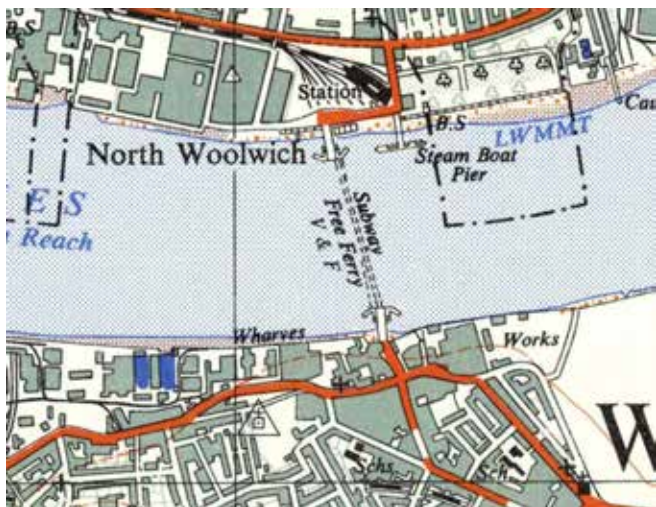
From Greenwich Heritage Centre



Tunnel section. From Greenwich Heritage Centre

leisure centre then cut the foot tunnel off and left it out of sight of the road. On the North Woolwich side the entrance is visible but isolated in the centre of roads jammed with vehicles queuing for the Free Ferry. The Woolwich tunnel is much less heavily used than the Greenwich one and – particularly on a nice day – many people prefer to use the ferry with fresh air and river views.

It was a surprise to discover that the existing Woolwich tunnel was in fact the second to be planned here. Research produced press cuttings of an attempt to build what appears to have been a private tunnel twenty years earlier. Investigations have failed to discover anything written on it apart from a series of press cuttings, all of which strangely are from provincial newspapers outside the local area. It appears to have been begun in 1877 under a Mr. Gilbert, engineer, with Messrs Sharp as contractors.



The Greenwich tunnel is shown on 1:10,560 (6") OS maps but for some reason the Woolwich tunnel is omitted. It is, however, shown on this 1961 1:25,000 OS map running between the two ferry terminals. New terminals were built to the west in 1965

It is said that it resulted from an accident on the Thames where eight people were drowned trying to cross the river when the regular ferry was not running due to fog. It was to run from near the Great Eastern Railway station in North Woolwich and terminate in Woolwich High Street accessed by 'an enclosed road.' The tunnel would be 1,800ft long and would lie 25ft - 35ft below the river bed. It was to be made up of a circular tube of iron 9ft in diameter and about 12ft in height. It would take four people walking abreast. The press commented that it would be very useful to take troops and artillery guns across the river. However by 1879 work was 'in abeyance'. It might be of interest to know if any remains of this attempt still lie on the river bed or indeed on the foreshore.



Despite heavy rain, crowds gather for the opening of the Woolwich foot tunnel on 26 October 1912



Woolwich tunnel lift probably on the opening day. Both this and the picture above are postcards produced by local company Molyneux Brothers of William Street, Woolwich. Photo from Greenwich Heritage Centre

The existing Woolwich foot tunnel was opened ten years after that at Greenwich, in 1912 by Lord Cheylesmore the then Chairman of the London County Council under Maurice Fitzmaurice who was then Chief Engineer to the County Council. It was built by Walter Scott and Middleton. Construction began on the north bank in 1910 with workers digging by hand and the tunnel continued to be dug in this way and, like other tunnels, used the Greathead shield. The tunnel is 1,655 feet long and the top is 10 feet below the river bed – covered by 38 feet of water at low tide and 69 feet at high tide. It is a cast-iron tube made of a series of connecting rings.



Like the Greenwich tunnel it is lined with white ceramic tiles but with a kerb of sandstone and a floor of pre-cast concrete granolithic. Lifts were not allowed for in the original scheme and they were added later in the project at an additional cost of £5,000 with manually operated gates. Like the Greenwich lifts they were replaced in the early 1990s with the original panelled interiors retained. The rotundae are red brick on a plinth of blue engineering brick, with sash windows protected by iron grilles and above the parapet is a conical roof with circular copper-clad lantern rather than the glass-covered cupolae of the Greenwich tunnel. Unlike the Greenwich tunnel there are separate entrances for the stairs and the lift and these entrances have glass canopies on cast-iron columns. These street-level buildings were listed Grade II in 1989.



After years of use the white ceramic tiles are looking very dirty in this view looking south before the tunnel was refurbished in 2011. Photo from Hartwell Photography



After refurbishment the tunnel is looking clean and bright much as it did on the opening day. Photo Andy Hebden

Both tunnels carry services for power, lighting, CCTV, water, ventilation and drainage. Power is provided from both ends as a failsafe in an emergency. There are 14 fixed CCTV cameras which could be monitored by a lift operator, and which are now passed to a central control room in Woolwich. There are hydrants in the tunnels for water supply and both tunnels have drainage sumps at their lowest points to clear any accumulation of water. The tunnels have a leaky feeder system to allow the use of mobile phones.

Hundreds of people daily use the tunnels to cross the river. A survey of 2007 found daily use at Greenwich to be about 2000 on weekdays and 3000 at weekends; and 2000 for weekdays at Woolwich falling to under 1000 a day at weekends. Pedestrians have been joined by many cyclists and for them these two tunnels are the major crossing points down river of Tower Bridge with the only choice being the Free Ferry, and, to a very limited extent, the Rotherhithe tunnel. Cyclists made up about 10% of users at Woolwich and 30% at Greenwich and these figures are rising. At Greenwich in the morning rush there is double the number of cyclists than pedestrians northbound – and this density and the speeds undertaken by some riders have proved a safety problem.

The tunnels are now over a hundred years old and beginning to show their age. Many visitors found them dirty and damp with drips from the ceiling, lifts not functioning and a generally threatening and sinister atmosphere. They remained very busy. In 2008 it was agreed that they needed to be refurbished.



The Rotunda at the north end of the Woolwich tunnel before refurbishment



Down below the photographer describes his experience "With the broken lifts (no longer staffed, even if they were working), general poor state of repair and alternative crossings available by means of the ferry and DLR, what was already probably the least used Thames crossing has become creepily quiet. Hearing two guys howling down from the Woolwich end set the hairs on the back of my neck up. Just a couple of lads but I can see why other people wouldn't want to come down here." Photo Nico Hobb

## Refurbishment begins

Work began in 2008 funded by the Department of Communities and Local Government supervised by the Homes and Communities Agency and managed by what was then the London Borough of Greenwich and due to be completed after two years, although the Homes and Communities Agency noted the project as ‘high risk’. A report in late 2010 noted that ‘Work on the tunnels is proceeding well’. Doubts on progress surfaced soon after and in early 2011, it was said that the Woolwich tunnel would require “more extensive works than expected”. The stairs at Greenwich reopened on time in 2011 but were so heavily boarded as to cause difficulty in use. The completion date for all work in early 2011 came and went with various reasons given for delay and new dates for completion given. Only too visibly this was unlikely to be so. As 2012 neared, when the tunnel would be needed as a river crossing during the Olympics, public disquiet grew.



Before refurbishment the Greenwich tunnel was also grubby and unwelcoming

The Homes and Communities Agency which had been overseeing the project was wound up and its functions transferred to the Greater London Authority who at first seemed unaware of the problems. This agency reorganisation took time, and with the project still incomplete there were many questions presented to Greenwich Council in the local press, among a group of local bloggers – and from concerned backbench councillors.

Greenwich Council’s response was to launch an inquiry, and to dispense with the contractors who had worked on the project to date. The Greater London Authority eventually took notice and admitted that it had the responsibility to help steer the works to a successful conclusion. Following a Greenwich Council Cabinet decision to appoint new contractors exploratory meetings were held with them.

## Friends of Greenwich and Woolwich Foot Tunnels

At this point it was decided to set up FOGWOFT – Friends of Greenwich and Woolwich Foot Tunnels. FOGWOFT was started by activists from Greenwich cyclists. They were aware of the need for the tunnels as the main means of a river crossing for cyclists as they were also aware of the growing call for answers to what

was going wrong. They were however keen to work with Greenwich Council and to help overcome difficulties while at the same time getting information about the problems and how they could be fixed into the public domain. They also felt that it was important that once works were finished that there should be an effort to get more public awareness of the tunnels and their heritage – they needed looking after by some Friends.

A public meeting was held in September 2013 with an audience of over sixty – including some local, and indeed national, luminaries plus some enthusiastic tweeters. A committee was set up, chaired by a Greenwich backbench councillor. There was also a contingent from the Isle of Dogs and the committee has always had a representative from tunnel users on the Island. Attempts to recruit representatives from either end of the Woolwich tunnel have proved more problematic, although there is now a keen member from Newham.



Refurbishment underway in the lift room in the dome of the rotunda at the south end of the Woolwich tunnel.  
Photo from FOGWOFT



The Woolwich rotunda. The listed structure is now hidden behind the Waterfront Leisure Centre. Photo from FOGWOFT

In 2013 with works still in a complete mess Greenwich Council published the results of its enquiry: the Wilmoth Report. This report was presented to the Council and was critical of project management by all concerned but especially the overdesign of some aspects and of





the cost-plus basis of the main contract. The report also commented that while work on the tunnel was a small job for the construction industry it was nevertheless unique and complex in a way that had not really been appreciated.

The refurbishment works recommenced in October 2013 a month after the public launch of FOGWOFT. This Friends group has continued to work closely with Council officers and reported on work as it has been completed. Members have had several visits to see the problems faced by the construction team – they can hardly be called tours of the works, since the area involved is small and cramped.



The refurbished south rotunda close to the *Cutty Sark* at Greenwich. A separate entrance was provided for people using the lift and the stairs. The plaque illustrated above is seen above the entrance doorways. Photo by Diliff



Detail of the glass dome of the south Greenwich rotunda. Photo from FOGWOFT

FOGWOFT has been keen to find ways of drawing attention to the tunnels and to their heritage. The first social event was to commemorate the 101<sup>st</sup> anniversary of the Woolwich tunnel – then completely covered in scaffolding which had created great difficulty in actually finding the entrance. The celebration consisted of a saxophonist, cup cakes and a walk through the tunnel – with an audience consisting of FOGWOFT activists, the press and a group of cycling councillors and council

officers. It all went down very well. This summer a rather larger group has walked through the Greenwich Tunnel to a picnic in Island Gardens following speeches and music in Cutty Sark Gardens to the bemusement of tourists.

As work progressed problems with these century-old structures were uncovered as well as problems of drainage and with the formation of miniature stalagmites as condensation drips onto the floor. The need for drainage was recognised by the tunnel builders and sumps, drainage channels and pumps provided – it is said that it is accepted that all such underwater structures will suffer some water penetration. Nevertheless the most difficult points have been addressed in the remedial work – in particular water ingress in the lift pits. An added problem has been that the water from the Thames, highly polluted during the first fifty years of the tunnels' existence, contained corrosive substances which will have led to additional problems.

The clear wired glass on the Greenwich tunnels' domes had the dirt of decades on them and people assumed the murky look was traditional. English Heritage agreed that the new laminated glass would have a faint white smoke tint to reproduce that unwashed look! FOGWOFT was involved in discussions and a public consultation as to whether the tunnel should be retiled or whether the traditional tile work should be cleaned but remain, however scarred.

Scarring was particularly difficult in the Greenwich Tunnel while graffiti defacements were worse in Woolwich. Although there was a clear majority of opinion that the traditional tiles should remain there are now complaints that they look dirty and it appears that however actually clean the tiles are, their age means they are never going to return to their original bright white state.



A new lift fitted at the north end of the Greenwich tunnel is not yet in use. The original wood panelled interior has been retained

The lifts at Greenwich were originally installed two years after the tunnel was opened and there are stories of gallant young men helping young ladies to descend the steps, sometime with bicycles. The lifts were replaced in 1992 and the beautiful original mahogany lift interiors reinstalled. These lifts had always been attended with staff members at both north and south lifts. It was now decided to install lifts which did not need to be manned

and thus new state-of-the-art lifts are now in place, complete with the original mahogany interiors – but there have been problems of constant lift breakdowns and many calls for the lift attendants to return.

One problem is that solar heat builds up under the listed glass domes. The electronic lift controls cut out at temperatures above 43deg C – The highest recorded temperature in the domes has been 56deg C. It has become a struggle to keep the new equipment cool and temporary air-conditioned boxes have been built round the control cabinets and industrial fans used. Even these could not cope and permanent cool boxes have been installed as well as back-up air-conditioning units and fans put on new steel gantries below the cupola. Since then the lifts have been more reliable – and it has all been a lesson in how advances in technology can produce systems more vulnerable to environmental change than old mechanical systems.



The north rotunda of the Greenwich tunnel is now overshadowed by the skyscrapers of Canary Wharf and is best seen from the river.

Photo from FOGWOFT

Work started to upgrade the Woolwich tunnel in 2010 and the tunnel closed during the day as work proceeded. However in 2010 the tunnel was closed completely because structural weaknesses were discovered in the stairways. It eventually reopened in 2011 although the lifts were not completed.

As the tunnels have returned to normal use FOGWOFT maintain there are challenges to be met. The by-laws rule that there shall be no cycling in the tunnel. This restriction does not appear to have been in place at first but dates from during the Great War along with a veto on the dropping of orange peel.

Orange peel no longer seems to be a problem, but the ban on cycling is ignored by the majority of cyclists. There are many vociferous calls for cycling to be allowed, and indeed encouraged, in the tunnels – but there are equally vociferous objections from pedestrians calling for policing and fines. While most cyclists are considerate the problem is with a lycra-clad minority who hurtle through the tunnel disregarding other users, including other cyclists. Barriers were installed at one time to



An artistic view of the spiral staircase in the north rotunda of the Woolwich tunnel. Photo from Hartwell Photography

force them to stop but these also provided a deterrent to buggy, pushchair and wheelchair traffic. This summer FOGWOFT was asked by Greenwich Council to help participate in a pilot scheme which would monitor electronically – and hopefully regulate – movement in the tunnel. It was thought that if this was successful it could be used elsewhere on narrow shared-use pathways – canal towpaths would be one obvious use. However, it has now emerged that funding for the scheme from the GLA is not forthcoming and as this article is written we wait for news from Greenwich Council Officers about new ideas and new initiatives to deal with this ongoing problem.

The tunnels are used by people from all sections of the community and safety must be paramount. There have recently been complaints from pedestrians about skaters – sometimes in groups – rivalling some cyclists in speed and arrogance. While work was ongoing the tunnel was shut on some nights in order to remove hazardous waste and it was then discovered it was used by a group of runners. Without realising the tunnel was to be shut on one night they had found themselves marooned on the Isle of Dogs having left their property in Greenwich and were in need of rescue.

Some problems have still not been completely overcome – the lifts at Greenwich failed again during the Tall Ships Festival, and it emerged that spare parts needed to be





specially made, in Germany. This problem is currently being addressed by the Council.

Thames crossings of all sorts have been proposed recently and there is currently a consultation exercise being undertaken on behalf of Transport for London. As a contribution to this debate at FOGWOFT's recent AGM it was suggested that the problems of cyclists who want to speed over the river could be solved by the provision of other tunnels paralleling the existing foot tunnels but for the use of cyclists. In the context of some of the other proposals this is cheap and cheerful.

FOGWOFT will continue to monitor the tunnels and hopefully help to make both of them better known and to enable them to become an important part of the Greenwich heritage which visitors come to see and provide not only a crossing place for them, and for locals, but also significant local places which might have a variety of other uses; there is space, for example for art works in the rotunda and for visually enhancing the look of both tunnels. The tiling may be degraded but it could be cheered up with plaques or posters.

Both tunnels continue to do the job they were built for a century ago, and do it efficiently and for free. Modernising them however, while maintaining their traditional features, has been more problematic than anyone thought – and has provided some valuable lessons. This makes an important point about the tunnels – they seem so simple – and yet they were major engineering works of their day, and should be appreciated as such. To quote one report to Tower Hamlets Council ‘they represent a magnificent feat of Edwardian engineering – impressive ambition of the project – the character is consistent and defined by the finest engineering techniques of the day – the design throughout ... and fabric is coherent, logical and simple and the materials used are robust and designed to last’. The ideology of the 1890s and the great legacy of the London County Council have left us these two tunnels,



The south rotunda at Woolwich and Bell Water Gate c 1950.

still performing their original functions and still free for everyone, as they were intended to be. We must learn to be proud of them.

*Sources - the material for most of this article was obtained verbally from construction team members on site at the tunnels. An article on the history of the Greenwich Tunnel by Myles Dove appeared in the September 2002 edition of the Greenwich Industrial History Newsletter. (<http://gihs.gold.ac.uk/gihs27.html#foot>). Other material has come from Dr. Skipper's presentation to Greenwich Industrial History Society (also unpublished). Material can also be found in reports to meetings of the three London Boroughs concerned – sometimes buried in minutes or as appendices.*

*Article in Engineer 4<sup>th</sup> April 1902.*

*Institution of Civil Engineers 1901-1902. Minutes of proceedings. The Greenwich Footway Tunnel by William Charles Copperthwaite. M.Inst. C.E. (much of this paper describes the arrangements made to allow construction to proceed)*

*Press cutting file Greenwich Heritage Centre*

*London Borough of Greenwich. Greenwich and Woolwich Foot Tunnels. Feasibility Study for refurbishment*

*A vast amount of information on recent events, largely written by Ian Blore, can be found on FOGWOFT's website <http://fogwoft.com/events/>*

## The Lisbon Metro – one picture is worth a thousand words

Martin Dixon

The Lisbon Metro in Portugal first opened in 1959 and has grown over the years to have four lines and 55 stations. For many years, it operated as a single line with branches but in 1995 separate lines were created.

These now number four and like many other metro systems are shown on maps with different colours – green, red, blue and yellow. Tickets are non-contact RFID (Radio Frequency Identification) based and fares are a flat 1.40 Euros per single trip.

What makes the system (in my experience) unique is that in addition to the line colour, each line has a distinguishing symbol. These are used on station names and on directional signs throughout the network, especially at connecting stations.

The symbols are based on what used to be more picturesque names of the lines as below:

Green – ship (*caravela* in Portuguese)

Blue – seagull (*gaivota*)

Red – compass rose (*oriente*)

Yellow – sunflower (*girassol*)

Introduced alongside the new lines in the 1990s, these symbols make using the system easier for tourists. The benefit is presumably greatest for those who are colour-blind or who have limited literacy. And of course they bring a little light relief to the platforms.



# Cold War Bunker at Easthampstead Park, Bracknell

Martin Dixon



Operations Room

Easthampstead Park is a Grade II-listed Victorian building on the edge of Bracknell in Berkshire. The estate started life as the site of a Royal Hunting Lodge in 1350 but the current structure dates from around 1864 when it was commissioned by the fourth Marquis of Downshire. During World War II, the seventh Marquis moved out and the house was used as a school by around six hundred boys from St Paul's School in Hammersmith.

After a postwar fire, the site was bought under compulsory purchase by Berkshire County Council and converted to become a female teacher training college – a not uncommon scenario in those days. It was earmarked to become the 'University of Bracknell' but this never materialised.

In 1966, the mansion was extended and the cellars (under the authority of the Secretary of State) were converted to become the Civil Defence Sub-County Control for Bracknell and East Berkshire. The County Control was in Shire Hall in Reading. Two years later, in 1968, it was upgraded to County Control as Shire Hall was no longer considered fit for purpose.

In 1981 the 1974-built new Shire Hall basement was converted for use as the County Control. Easthampstead Park was then downgraded to Berkshire County Standby and Bracknell Council Control, remaining in use until the end of the Cold War.

On 1 April 1998 Berkshire County Council was abolished under a recommendation of the Banham Commission and the site came under the control of the new unitary Bracknell Forest Council who used it as a conference centre. Unusually, the site is still in use for a related purpose, being the headquarters of the South East Berkshire Lowland Search and Rescue – a charity whose members help with searching for the young, old and vulnerable in conjunction with the police and other authorities.

## Sub Brit visit

A small Sub Brit group was welcomed by the current tenants in early April 2014; attendees made a contribution to the charity's coffers. The main entrance to the subterranean bunker is down a ramp from the stable yard and the rooms below are described in an anticlockwise sense from the bottom left of the adjacent plan.

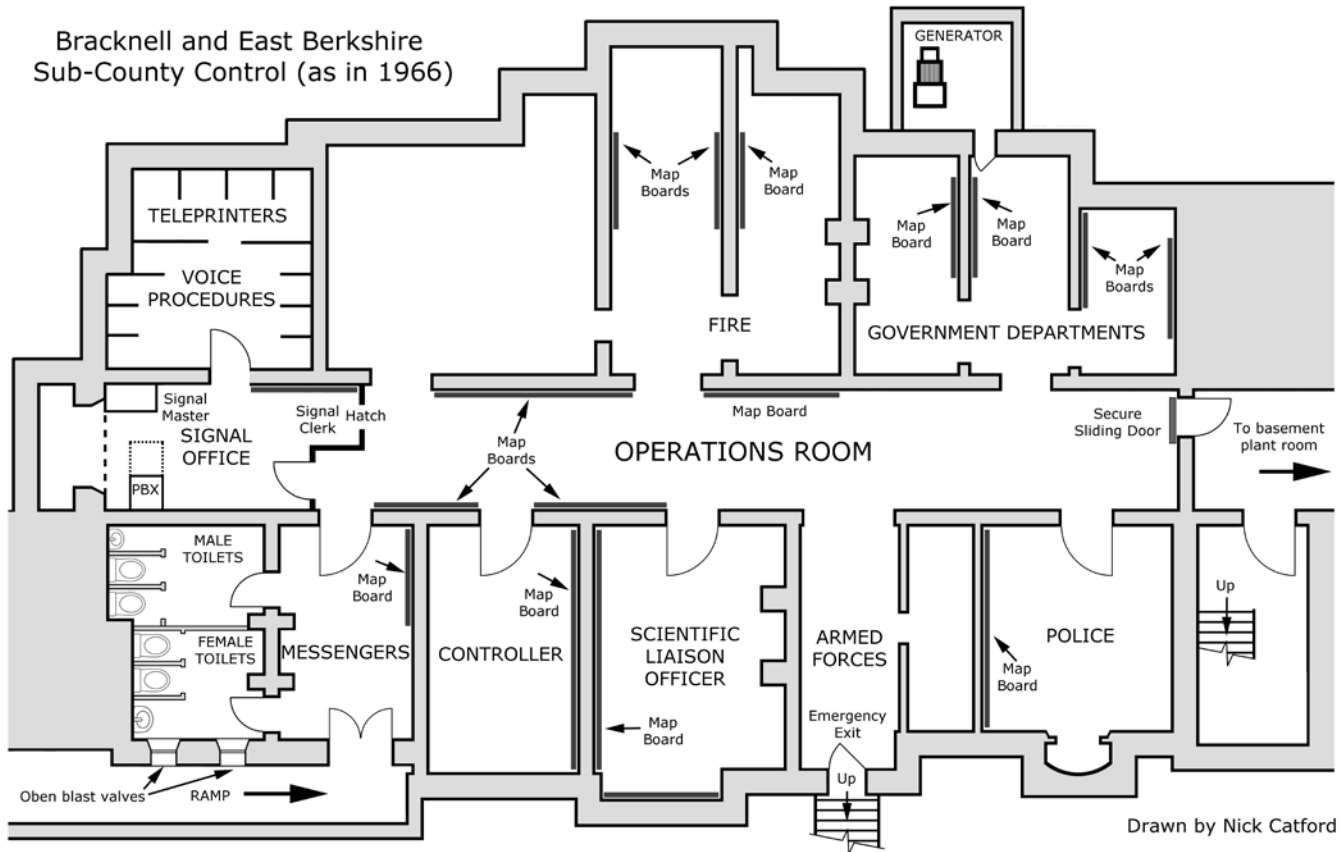
The original (that is, Cold War) purpose of each room is listed, followed by current usage and contents. The rooms were originally part of the domestic accommodation of the Victorian mansion but apart from two rooms described later, it was not possible to discern their original purpose.

**Male/Female Lavatories.** Still in use as lavatories but for some reason the male/female designation has been reversed at some stage versus the plan. The male toilets (which now include an outside wall) incorporate 'Oben'





Bracknell and East Berkshire  
Sub-County Control (as in 1966)



blast valves which would have closed to minimise damage from any pressure waves associated with a nuclear strike.



The 'Oben' blast valves in the male toilets

**Messenger Room.** The main entrance opens into what was a messengers' lobby, now used as an entrance hall. At some stage since the original plan, decontamination showers have been added to the right-hand side (on entering) of the room.

**Operations Room.** Intriguingly, what was the Victorian corridor linking the various cellar rooms was used as the main Operations Room. The construction of the cellar was of brick wall with the ceiling being shotcreted. Both surfaces are overpainted and little evidence remains of the original mapboards. Today, the room is once again in use as a linking corridor rather than a room in itself. Adjacent

to a hatch on the left-hand wall is a WB1401 receiver and linked loudspeaker that would have been used to receive warning of any impending attacks or approaching fallout. The receiver is marked *Oxford 41/133/150*.



WB1401 receiver (right) and speaker in the Operations Room.

Below them is a message hatch into the Signal Office

**Controller's Room.** This is now in use as a locked first-aid store and was not entered.

**Senior Information Officer.** Now converted to a kitchen area with appliances and dining seating by the current tenants.

**Armed Forces.** A surprisingly small room compared to that of other authorities and now used as a 'dirty store' for wellington boots and protective clothing. The hatch of the original escape exit is still in situ but could not be opened.



The Armed Forces room with the emergency escape hatch in the rear wall



Emergency generator. A filter drum is sitting on the floor

**Police.** This room is now converted to a training classroom with teaching aids (posters, whiteboards and so on) and classroom-style seating. As such, it retains the feel of the original control more so than other rooms.

At the far end of the Operations Room a secure sliding door gives way to another exit stairway. Beyond this point and from a later date is the current boiler room for the property. This retains what at first glance appear to be blast doors but which on closer examination show that the boiler room occupies what was originally built as the strong-room for the house. An old wine cellar (never converted for Cold War use) is adjacent to the boiler room.

**Government Departments.** Now used to store stretchers and similar large items. Beyond and through a small door part way up the rear wall, is an emergency generator which looks to date from the 1970s. The generator provides emergency power for the whole house.

**Fire Brigade.** Still used for a related purpose, the room has been set up with a search and rescue 'rat run'. This is



Ventilation plant at the rear of the Fire Brigade room

a three-tier assembly of wooden crates, with removable faces so that an enormous number of different structures can be produced to simulate searching in cramped and narrow spaces. At the rear of this room the 1980s ventilation plant remains. This includes a pump, filters, anti-explosive valves and an emergency hand-crank.

**Signal Office.** Now used as a small workshop by the search and rescue team. The adjacent **Teleprinter and Voice Procedures** rooms are still in use with a communications role, being the stores for the unit's radios and emergency lighting.

All in all, this is an interesting and unusual reminder that many County Controls were converted from the existing county-owned real estate rather than being purpose-built. A number of original features still remain which are presumably and hopefully offered some protection by the building's Grade II Listing designation.

Thanks are due to South East Berkshire Lowland Search and Rescue and to Paul Chapman for facilitating our visit. All Photos Nick Catford



The emergency generator is located through this high level door located at the rear of the government departments room





# Cat's Lairs

## Cold War Shelters for the Slovenian Leadership, 1949–51

Aleksander Jankovič Potočnik



In Bunker 2 one chamber has wooden flooring. Through the opening at the end leads to steps up to a high level surface entrance that is now bricked up. Photo Žiga Ribič

we exclaimed enthusiastically.

“Yes, Manlicher indeed,” replied Žiga, “they are still unfired.” “Did you hear that?” said one girl to another: “Manlicher!” “Yes, Manlicher,” said the other one and observed: “I don’t think our presence here makes any further sense.” And off they went.

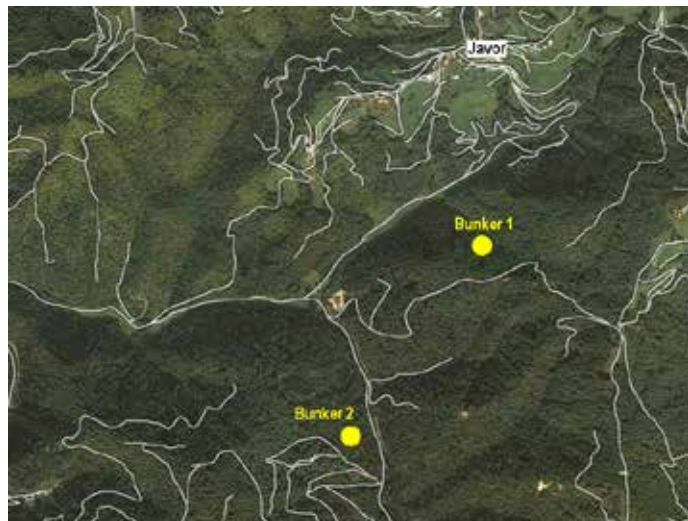
Such was my first encounter with Žiga Šmit who another friend, Igor Seljak, is now describing as a Slovenian Indiana Jones: “He’s a university professor, a researcher, an archaeologist and an adventurer.” His list of finds is endless, composed of all sorts of treasure, ranging from Celtic and ancient Roman to WWII partisan camp sites.

Already as a youngster I was fascinated by the mountain battlefields of the First World War. About thirty-five years ago I and my friend Zoran, another WWI aficionado, visited a camp near Bovec, a town in the Slovenian Alps where the trench lines traversed the valley and surrounding peaks. We were told to contact the camp leader Žiga Šmit, who supposedly knew a lot about the former battlefield.



The entrance to Bunker 1. Photo Aleksander Jankovič Potočnik

Igor told me that Žiga has managed to locate two underground shelters just east of Ljubljana that were constructed between 1949 and 1951 and that he was willing to lead us there. Shelters aren’t really my cup of tea – I prefer real fortifications. But I nevertheless gladly accepted an invitation. Even if only to meet Žiga again after all these years.



### Introducing the Slovenian Indiana Jones

As soon as we arrived two girls appeared to size us up. They themselves were worth a glance or two, but the conversation was brief since the next minute there appeared Žiga Šmit: “I understand that the two of you are interested in the First World War,” he said. We confirmed. “Then you may be interested to see what I’ve just brought from the hills,” said Žiga, and unwrapped a small parcel he was carrying. “Hey, these are Manlicher cartridges!”

### Cat's Lairs

Even though they are no longer an official secret, the two shelters are still rather unknown and both Žiga and myself were only able to assemble some basic picture by combining small pieces of information from different articles and internet posts.

During the Second World War the Communist party of Yugoslavia managed to obtain the leading role in the resistance movement against the occupying Axis forces.



This in turn enabled the Communists to take over the government and introduce a socialist system as soon as the war was over.

At first glance Yugoslavia was in this regard not different from any other eastern country of the time, but there was one significant difference. As opposed to others Yugoslavs did not owe its new system to the Soviets – it was of Yugoslavs' own doing. So it wasn't long before Yugoslav leader Josip Broz Tito felt Stalin's influence to be oppressive and there occurred big tensions between Yugoslavia and the Soviet Union. They culminated in 1948 in a decisive and public schism. Yugoslav leadership feared the Soviets might react violently – maybe even by using nuclear bombs. Quick preparations for such an event were ordered.



Looking east towards the entrance of Bunker 1.

Once through the concrete lined entrance tunnel some sections of the bunker are unlined. Photo Žiga Ribič

After the Second World War Yugoslavia was a federal state composed of six constitutional units or republics, as they were called. After the break with Stalin, plans were made to provide shelters for the leaders of the federation as well as for each of the republic leaderships. They were immediately put in motion. Near the village of Pance, just east of Ljubljana, two deep shelters were constructed. Each of them was capable of housing about one hundred persons. The construction started in 1949 and was interrupted in 1951, before the two shelters were really completed.

Instead of them another shelter was built much further away from Ljubljana. This third one was completed, made functional and is still well maintained. Except for a short period after 1991 when Slovenia gained independence from Yugoslavia, it remained off-limits for the general public. The two unfinished shelters close to Ljubljana were also guarded until 1991, but then remained abandoned. It was lack of interest rather than secrecy or guards that kept them away from the general public's awareness.

While official data is virtually non-existent we may nevertheless assume why the two shelters were abandoned. The telling detail may be the fact who was employed on

their construction. As is always the case with mysterious constructions, some legends occurred. In this case it was a claim that German prisoners of war were used to dig the underground corridors and, what's more, that they were liquidated afterwards in order to secure the secrecy of the location. But according to testimonies of the locals the workforce used was actually Yugoslav Army personnel.



Looking north along last concrete-lined chamber in Bunker 1. Beyond this a narrow unlined tunnel leads to an unfinished stairway to the surface. Photo Žiga Ribič

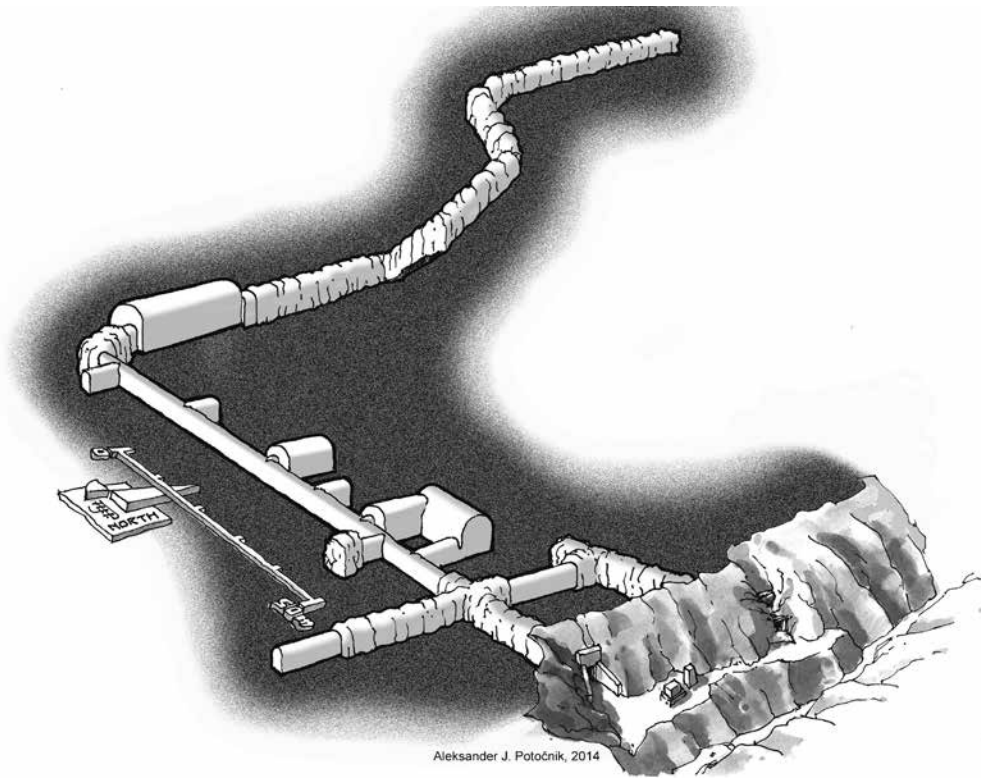
On the other hand, in the construction of the new, more distant shelter, completed in 1958, the workforce were indeed some prisoners. This may indicate that the responsibility for the anti-nuclear protection passed from the army to the ministry of the interior. This would in turn mean that the then Slovenian state security chief, almighty Ivan Maček–Matija (1908–93) was responsible only for the construction of the last shelter. Yet they were all attributed to him and hence all called “Mačkovi bunkerji”. Since the word “maček” means “the cat” this could – with some artistic liberty – well be translated into “Cat's Lairs”.

### Visiting the Bunkers

In Slovenia these sort of underground shelters are called bunkers. “Bunker” is a term used very liberally in Slovenian language. It marks anything from a combat block to underground shelter and even a storage for forbidden films and books. The two “bunkers” we have visited are very close to the public road, yet they are not easy to find. The two gullies leading to them are branching from the main valley, served by the sealed local road, and are almost invisible from the road, well hidden by a dense forest. So one must know rather well what he or she is looking for.

Žiga Šmit certainly knew what he was looking for, so our group of four found the first of our two destinations without any trouble. The shelter has two main entrances. The first one has collapsed, but was repaired. The elements used to stop the soil from filling the entrance are typical Yugoslav People's Army prefabricated concrete elements, used to solidify trench systems. Designed in the seventies, they indicate that the army was still keeping an eye on the place at least three decades after its construction.





Bunker 1. Plan drawn by Aleksander Jankovič Potočnik

The other entrance has been walled off. The entire entry section is still a rough rock. Only in the corridor further inside was the concrete already poured. There are three bigger halls with an average width of about five and a half metres and four small chambers, all lined along a single corridor that makes a sixty-degree right turn just before reaching the last of the big halls. The floor is littered with empty revolver and pistol cartridges.

Apparently the shelter is used as an unofficial shooting ground, but we couldn't work out by whom.

After the last hall the corridor continues. At the end there is a shaft leading upwards. Clearly it was meant to be a stairway, carved into the rock but never made in concrete. Climbing up was easy. The ground at the top is littered by beams once supporting the ceiling, but now merrily rotting away. Roots protruding from the ceiling told us we were very close to the surface, but the exit

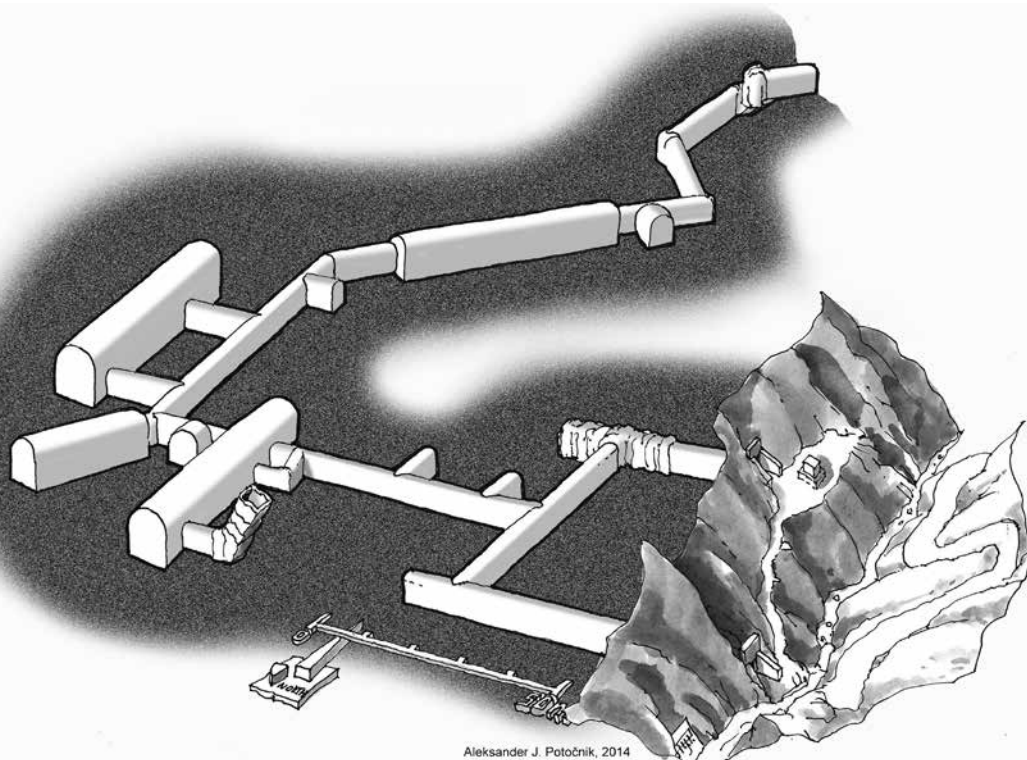
was never completed and we had no choice but to return the same way. Climbing up might have been easy, but descending down the unfinished shaft wasn't such an easy matter and we were glad that Žiga had brought with him some rope.

### The second bunker

The gully with the second shelter lies a couple of hundred metres eastwards, further away from Ljubljana. Just as was the case with the first shelter, here too a concrete block stands in front of the entrance. It reminded

us of either a generator base or a base for a cable lift, but we couldn't work out its real purpose. The entries to the second "bunker" are better preserved. But again one of them is walled off.

The entire structure appears to have been completed, with one hall even having the secondary walls painted and wooden flooring laid. This hall had a life of its own and signs of partying can be seen everywhere. CDs were



Bunker 2. Plan drawn by Aleksander Jankovič Potočnik



Looking east towards the entrance from the first junction in Bunker 1. Photo Žiga Ribič



A large concrete lined chamber at the back of Bunker 2. The entrance on the left leads into the main tunnel network.

Photo Žiga Ribič

view for a shelter built to host the country's leading communists.

### Future, if any ...

Igor and myself made some basic measurements. Good enough to make some rough presentations, but little more. Both of us had been participating in documenting some objects that are part of the nation's cultural heritage. The documentation was then used for planning the renovation and future use of such objects. But in this case we had no such agenda.

We can't even say who the current owner of the two shelters is, let alone plan any future use for them. And maybe that's quite all right. Why not leave something to remain a semi-obscured mystery? Apparently such a mystery does have an appeal, as was clearly illustrated by the arrival of two youngsters that came up the valley just as we were leaving the second shelter. Their goal was clearly the same as ours – to visit the unknown "Cat's" underworld.



The entrance to Bunker 1. Photo Aleksander Jankovič Potočnik used to decorate the walls in a disco fashion while some flooring has been burnt – either by accident or for heat. In other halls some empty cartridges can be found as well, but in far smaller quantities than in the first shelter.

Huge quantities of small white plastic balls suggest the shelter is often a site for air-soft games. There are four larger halls all together, with two of them detached from the main corridor, and seven smaller chambers. The hall closest to the entry has an unfinished vertical shaft, indicating that this could have been planned as a generator room. At the very end of the shelter there is a stairway – in this case completed. The exit is walled off, but through the hole in the wall one can see a church on the opposite slope of the valley. A strange



Looking east along the entrance tunnel in Bunker 2. A junction can just be made out on the right; here a concrete lined tunnel is the route into the bunker. Photo Žiga Ribič





